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THE
BRITISH NOCTUÆ
AND
THEIR VARIETIES.

VOL. 2.

TUTT.



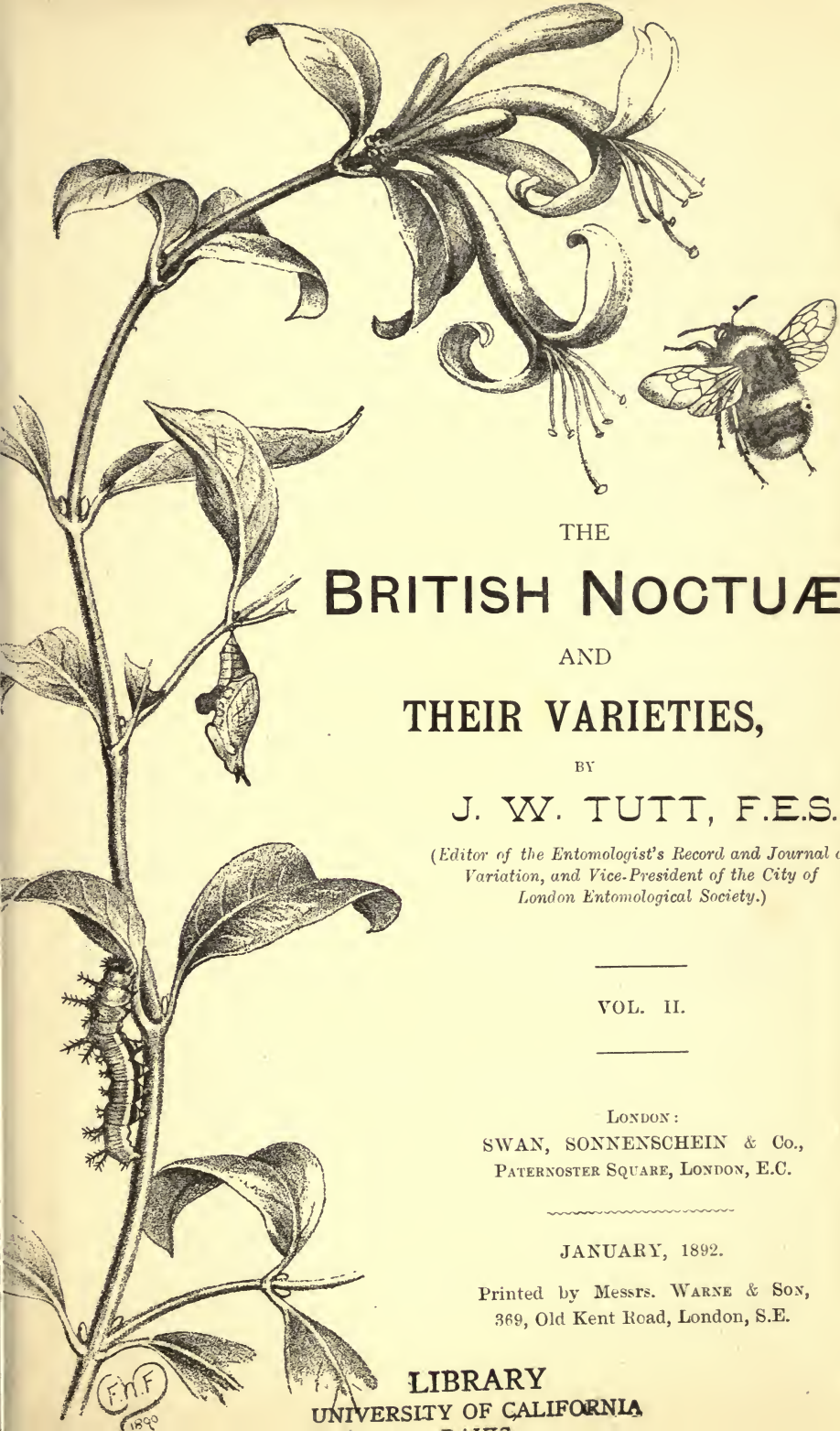
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THE
BRITISH NOCTUÆ
AND
THEIR VARIETIES,

BY
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VOL. II.

LONDON:
SWAN, SONNENSCHN & Co.,
PATERNOSTER SQUARE, LONDON, E.C.

JANUARY, 1892.

Printed by Messrs. WARNE & SON,
369, Old Kent Road, London, S.E.

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CATALOGUE

OF

THE SUB-CLASSES, FAMILIES, GENERA,
SPECIES, VARIETIES AND PRINCIPAL SUB-
VARIETIES

MENTIONED IN VOL. II. OF

THE

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London :

1892.

INTRODUCTION.

In the introduction to Vol. I of this work, I referred shortly to the extent and probable causes of variation in the *Nocturæ*, and do not now propose to travel further in the same direction, but rather to extend the view over a few particular points not then dealt with. There are, however, one or two suggestions previously mentioned which have received valuable confirmation during the last few months, and to these I will briefly refer.

In the introduction to Vol. I., pp. xv-xvi., I referred cursorily to disease, as being a potent factor in producing variation, generally in a direction tending towards melanism. Mr. Merrifield, to whom we are greatly indebted for some valuable experiments relating to the influence of temperature on pupæ in producing colour variation in the resultant imagines, has made further experiments this year, one of the species operated on being *Vanessa urticae*. I was fortunate in being present at the meeting of the London Entomological Society when these specimens were exhibited, and my idea that the darkening produced in Mr. Merrifield's experiments was due to some form of disease received the fullest confirmation. The specimens exhibited did, certainly, display a fair amount of variation, and those which had been exposed artificially to the greatest and most continued cold were the darkest, but, at the same time, with scarcely a single exception, were all more or less deformed. The result of the application of artificial cold here becomes self-evident. The suspense of the vital functions, at a time just previous to emergence, when they should be most active, undoubtedly affects injuriously the constitution of the pupæ, the resulting imagines, if any, being deformed, ill-developed as to scale structure, and may become rather paler, or darker according as the retrogression naturally tends towards a paler or darker coloration. The influence of excessive artificial cold, in producing variation is now comparatively clear. It appears to be entirely indirect, and simply acts by producing a diseased condition in the pupa, and a resultant imago more or less deformed. It also appears to prevent the proper formation of pigment and hence produces, as it were, an excess of non-pigmental scales at the expense of the normal ones. The general obsolescence of characteristic colour and markings, in those species which are essentially Arctic, is now explained, as we see that the vital functions are less active and therefore not so capable of developing scale and pigment. In some butterflies, the resulting influence differs from that in some moths, as the influence of "natural selection" is generally so essentially diverse in the two groups; and the result of retrogression is also different. As an illustration of what I mean, it may be safely assumed, that the red-brown of *polychloros* and the bright red of *urticae* are both equally developed through yellow. Both are almost equally soluble as pigments, passing through yellow to

white, and their pigments readily bleach, although the brighter red of *urticæ* is perhaps more rapidly soluble, showing that the greater elaboration tends to greater solubility. Strong ammonia dissolves the red of *urticæ* very speedily. It results, therefore, that the brighter colour of *urticæ* is due to a fuller, and probably more rapid, development of the pigment in the pupal stage, and that, if the formation in the pigment in *urticæ* be stopped in the process of its development from the pigment-producing material, that the less perfectly developed colour would result. Further than this, since we must assume that the waste product which is to form the pigment has been stored up in the larval stage, and simply undergoes elaboration in the pupal stage, it follows, that the less highly developed colour, *i.e.* the one which is produced by the least elaboration, must be the result in those instances where the vital processes are for the time being, stopped, as is undoubtedly the case when the pupæ are subjected artificially, or otherwise, to a very abnormally low temperature. This would readily account for the production of the dull coloration in the ill-developed *urticæ* before mentioned, and the tendency of the dark ground colour to occupy the space usually filled up by the pigmentary structures.

That the apparent result will not always be the same in different species, and that sometimes this incomplete development of pigment may tend to produce a duller (darker?) and sometimes a paler imago, is readily seen; but, it is clear, that in all cases, an obsolescence or tendency to obsolescence of positive markings must ensue. For example, the pigment may be produced in scales having a base or framework of white or black (or, in fact, any other colour). In other words, the colour of the scale is independent of the colour of the base. Now, if we dissolve all the pigment from the yellow portion of the wing of *Colias edusa*, the resultant wing is white, whereas, if we dissolve the pigment of *Vanessa io*, the resultant colour is black. Hence, a retrogression of, or failure to develop pigment in the former, must, I think, tend to produce dull, whitish specimens; the retrogression in the latter to produce black specimens with a more or less diaphanous tendency. The normal colour of the basement structure of the wing must, therefore, have a considerable influence on the net result.

In the same way, it results that retrogression in the case of *Vanessa urticæ* ends in darkening the ground colour, in other words, of increasing the dark at the expense of the bright colours of the wing, and also frequently in the simultaneous change of the bright *urticæ*-red into an approach to the duller *polychloros*-red. On the other hand, I consider the black form the most highly developed pigment coloration, in a species like *Tanioscampa instabilis*. It has reached this form through brown, red and ochreous from white. Here, then, retrogression would tend to produce a pallid coloration, thereby having a diametrically opposite tendency, in a gradual change, from what results in *Vanessa urticæ*.

To refer to another point. In the Introduction to Vol. i., p. xiv. I just mentioned that Lord Walsingham had suggested that any cause tending to lessen the proportion of chemical rays of the sun reaching the earth in any particular locality, might influence the colour of lepidoptera. Mr. Merrifield, by feeding larvæ under differently coloured glasses, and by filtering light through bisulphide of carbon &c., attempted to get some results in this direction. When giving an

account of his experiments to the Entomological Society of London on December 2nd last, he said his results were absolutely *nil*. Mr. Poulton, who had similarly experimented on larvæ of *Gnophos obscurata*, reported equally negative results. This fully bears out my supposition when I stated in my work on 'Melanism and Melanochroism in British Lepidoptera,' p. 50,—“At present I am unable to see any connection between cause and effect in this direction.”

With regard to the coloration of lepidoptera, we now come to a most interesting branch of our study, and, at the outset, we may classify the colours under two heads. The colours produced simply by interference &c., of light waves on the surface of the wings = non-pigment colours; those produced by the light entering the scales and being partly absorbed and partly reflected, the resultant colour being given by the reflected portion = pigment colours. I have seen the unhappy term “physical,” occasionally applied to the former class, as if both classes be not in reality physical colours. It is probable that every shade of colour exists in some insect or other, both as a pigment and non-pigment colour, not even excluding white and black, and that although in almost all cases the natural evolution of colour has been from white, the result is frequently obscured by the colour being developed in or on normally black scales, or in or on a scale which is normally some other colour than white, and where retrogression in colour appears to travel not towards white, but undoubtedly towards black, and hence the essentially different results frequently met with, when our premises appear to warrant us with expecting at any rate a somewhat similar result. It is difficult, too, at times to differentiate clearly between a pigmentary and non-pigmentary colour, and transitions are very frequent in a state of nature, *i.e.*, of essentially non-pigmentary coloured species presenting traces of pigmentary development, and it is not always clear whether this should be looked upon as a progressive or retrogressive development. But I think, in almost every instance, it is a progressive development, when normally non-pigmentary species (or rather scales) develop pigmentary matter.

Pigment is now generally considered to be essentially a waste product. The excess, or otherwise, of the food may, in this way, have some direct action on the general coloration, especially in the shade &c., developed. The kind of food, so far as relates to its chemical composition, I believe to have but little, if any, action whatever, and this I fully explained some time since in 'Melanism and Melanochroism in British Lepidoptera,' pp. 58-60. It seems impossible that this should be so, because the vital processes of assimilation taking place in the larva, change the vegetable into animal tissues and thus decompose the food into its various constituents, elaborating that required into its own tissues, and excreting the remainder as waste. When we come to consider the quality and quantity it is different, and an excess of food with a consequent excess of waste in the tissues may, and probably does in most instances, become converted into pigment-producing matter. An illustration of this kind has come under my observation. Some years ago, I bred and interbred *Selenia illustraria*, and I must own that I was very careless as to food (both quantity and quality). The result was that the brood “ran out,” became very small, and what should have been the richly coloured spring brood, differed but little in coloration from the less highly coloured summer brood. I know of

other instances of the same kind. Mr. Adkin, at a recent meeting of the Sth. Lond. Ent. Soc., commenting on this said, that by careful breeding and by giving a plentiful supply of food, he kept up the seasonal dimorphic condition in this species, and obtained large and richly coloured spring broods from his interbred specimens. Here the varying results arrived at are clearly referable to the difference in food supply, and, if we look on the better fed specimens as having an excess of the waste product necessary for pigment formation, it is certain that the ill-fed specimens had no such excess and the colour suffered accordingly. Applying this to the normal condition of this species, what do we find? The imagines that emerge as the spring brood are feeding from July to October (about three months), whilst those that emerge as the summer brood are only feeding from May to June (less than two months), and hence, there is a smaller surplus in this brood, exhibited both by its almost uniformly diminished size as well as paler colour. Of course, I do not forget that "natural selection" &c., have also something to do with this. In the allied *S. illunaria* under parallel conditions, similar variation in size is accompanied by similar retrogression in colour, the brown ground colour and purple lines, being changed to ochreous and red respectively. I am here dealing with the primary elements on which "natural selection," "meteorological influence" &c., have to work in order to bring about the final result as exhibited in the seasonal dimorphism of these species.

Having now noticed what pigment really is, we may attempt to trace the pigmentary colours in a genetic relationship, and our studies in variation lead us through the following changes:—(1) white, yellow, orange, red, brown, black. (2) white, yellow, green, red (or brown), purple (or blue), black. Probably green is sometimes modified almost directly into blue.

Of the non-pigmental colours, the simplest are white and black. The former is apparently caused by the utter absence of anything but air in the cells, and is wholly and essentially due to the surface reflection of the incident rays of light. This is the case in normal *Hepialus humuli* ♂, *Euchlœ* (*Anthocharis*), *Pieris* &c., and also in male *Aporia crataegi*, but there is another form, or condition, even lower, or more retrograde, than this. I refer to the purely transparent scale which neither absorbs nor reflects light, but simply transmits it. It is common in some genera, and among our British species occurs in the female of *Aporia crataegi*. The male of this species has (as I have before remarked) essentially typical *Pieris* scales, non-pigmental, but clear white; in the female this is not the case, the scales (in the centre of the wing especially), becoming practically transparent, the membranous structure only preventing the wing becoming absolutely so. Here then we appear to get the simplest form of scale, on which the typical white of *Pieris* &c., is a decided advance. So much for white as a non-pigmental colour. We may now consider white as a pigment colour.

Perhaps the best example of white as a pigment colour is seen in *Melanargia galatea*. The pigment here is very unstable, so much so, that the mere presence of the fumes of strong liquid ammonia is sufficient at once to break up its original condition and produce a brilliant yellow, although, if exposed to air a short time, the pigment reverts to

its former condition. Long exposure to these fumes, or the direct action of liquid ammonia, renders the change comparatively permanent and the yellow is, more or less, retained. A solution of sodium-hydrate or potassium-hydrate will produce a similar result, and probably all the fixed alkalies will give a permanent change. The white of *Parnassius* and *Leucophasia*, of *Cheis* and of *Syrichthus* gives a similar result. Here then is a decidedly pigmental white, capable of being directly and rapidly influenced. Evidently, therefore, it differs very widely in constitution from the white of *Pieris*. The white colour in the fringes and undersides of certain *Melitææ* and *Lycaenæ* (*corydon*, *icarus*, *bellargus* &c.), is as unstable and subject to exactly the same rapid modifications as that of *M. galatea* &c., and is probably, of exactly the same character.

It now becomes easy to understand how readily "natural selection," environment &c., produce the bright orange varieties which the undersides of *Melanargia galatea* so often exhibit in various localities, and what an easy transition it is from pigmentary white to yellow. At the same time, it throws a side light on the development of yellow varieties of normally non-pigmentary species such as *Pieris rapæ* var. *novangliæ*, *Spilosoma menthastri* var. *scotica*, the sexual dimorphic coloration of *S. lubricipeda* and *Hepialus humuli*, the yellow underside varieties of *Pieris napi* var. *flava*, the yellow male form of *Fidonia pinaria*, which must be looked upon as the progressive form of the white male, and endless other similar varieties. From the analogy of *M. galatea*, I believe this change to be effected by the intermediary of an unstable white pigment to which, however, I have not yet obtained a clue. That such may exist is possible, when we consider the rapidity with which some species have their yellow dissolved and how very quickly they become transparent.

But now for an actual intermediate white. A non-pigmental white showing a tendency to produce yellow pigment is seen in many female examples of *Euchlœ cardamines* on the upperside of the posterior wings. The upper marginal area and the whole central area of these wings are frequently strongly suffused and tinted with pale ochreous, giving a distinct transition, whilst the development of the orange (sometimes yellow) tip to the male, is a further stage in the same direction, the apparent green on the underwings is in reality not green but yellow and black, and hence we see in every direction the tendency in this species to a yellow coloration. I may add that the orange-yellow is excessively soluble wherever developed in this species, and suggestive of comparatively recent (if not actually present) development. It is interesting to note, too, that occasionally the male has only the "orange tip" to one wing, and that its size &c., vary much. The allied *E. eupheno* shows distinctly this natural advance, and we have a species, where the suspicion of ochreous in *cardamines* has become permanent and the orange has a tendency to become red, thus showing the natural genetic relationship of these colours. It now becomes clear that there is a direct tendency for white to become modified into yellow, and we find many white species have forms, graduated from the purest white through faint ochreous to a brilliant yellow, as in the species I have just mentioned, and that this rapidly takes place where "natural selection" or environment demands it. This influence of "natural selection" is very prominent in the upper-

sides of *Spilosoma menthastri*, which becomes quite yellow in North British and Irish localities, although this particular form is comparatively rare in the South of England. This is really parallel to the intensification of colour in the undersides of butterflies, when we consider that the latter use their undersides for protective purposes and not the uppersides as in the genus *Spilosoma*. The undersides in *Melanargia galatea* are, as I have before mentioned, often strongly yellow, and it is strange that whilst the females of *M. galatea* are whitest (oldest form) on the uppersides, and the males more ochreous (more highly developed); yet, on the undersides, when it is necessary for the female to be more protected to perpetuate its species, the colouring is more intense than in the male, thus proving conclusively that in this instance the ochreous coloration is an advantage, and that although the males have broadly adapted themselves more readily to the change, the females, whilst retaining their original colour on the upper side, have adopted the advantageous colour on the lower. Yellow, therefore, in nature, appears to be a direct derivative from white, and when yellow or orange varieties of a white species occur, I look on them generally as progressive forms, whilst white varieties of normally yellow species are generally retrogressive forms. Of these latter forms *Urapteryx sambucata* var. *persica*, *Nemeophila plantaginis* var. *hospita*, the white form of *Rumia crataegata*, *Triphæna orbona* var. *pallescens*, *Heliodes arbuti* var. *albescens* are good examples. Two strange phenomena occur in *Lithosia mesomella* and *L. caniola*. In the former species two distinct types of coloration, white and yellow, exist side by side and are equally common, the yellow being probably a progressive form of the white, whilst *L. caniola* has a variety *lacteola* with the anterior wings white, probably the white in this var. must be looked upon as retrogressive, as must the var. *helice* of *Colias edusa*.

We must now consider the progressive development of yellow. As pigmented yellow coloration has been shown to be the more or less direct derivative of a white pigmented coloration, so we must look upon red and all its different forms, brown &c., as more or less direct derivatives of yellow. Pigmented yellow, however, may be of many various shades and tints, and extend from the pale hue of female *Gonopteryx rhamni* to the deep orange of *Colias edusa* and *Angerona prunaria*. Now although the transition, in nature, from yellow or orange to red is not particularly common, it very frequently occurs. In the year 1887, many of the *Colias edusa* captured, had distinct red shades, *Arctia villica* var. *fulminans* has the posterior wings red, *Spilosoma menthastri* ab. *lucerii* has the anterior wings rosy, whilst occasionally *S. lubricipeda* is so tinted. It is not difficult to trace *Cirrhaedia xerampelina* from pale yellow to deep orange-red and purple, *Xanthia cerago* (*fulvago*) is also traceable from the palest yellow to the deepest orange with a large quantity of red marks, whilst the bright red of *V. urticae* is essentially orange in its character as may be seen by careful examination of a considerable number. The numerous *Leucanide*, *L. impura*, *L. pallens*, *Tapinostola hellmanni*, *Calamia lutos*, *C. phragmitidis*, *Nonagria cannae*, *N. fulva* and many others, show the progressive tendency from ochreous to red, and there are other examples too numerous to mention. The retrogressive change of brown or red to yellow, however, is much more common; some examples of this will be mentioned later.

The way in which *Rumia crataegata*, *Venilia maculata*, and many other species, become pale yellow or white on exposure to weather, foreshadows the soluble and unstable character of many of the yellow pigments, although others are apparently much more stable. Amongst those which are easily soluble I have already mentioned *Euchlœa cardamines*, and there are beside, *Colias edusa*, *Gonopteryx rhamni* (male), *G. cleopatra*, *Hepialus humuli* ♀, *Fidonia atomaria* (male), *Abraxas grossulariata* &c., whilst some species which have rather more insoluble pigment, lose it and become bleached on continued exposure to light and air. I have seen the yellow of *T. pronuba* entirely removed in this way. But perhaps the fact that several of the yellow species may have their pigment absolutely changed in a progressive direction to red by the direct action of cyanide of potassium is still more interesting. It has long been known that certain *Colias* were so affected, as also *Gonopteryx rhamni*, such artificially produced vars. having been exhibited at our Societies from time to time, as if these were the congeneric species *cleopatra*, which has such a colour naturally, and which itself may be acted on (and its colour intensified) in the same direction. The yellow or orange is changed to red and, in most species, shades off regularly through orange, thus showing the complete genetic relationship. The natural development of red scales as a seasonal form of variation in *Colias cæsonia*, a normally yellow species, is very interesting (*vide*, 'Ent. Record,' ii., pp. 271-272).

It may be thus seen that all yellows from the pale whitish yellow of *Urapteryx sambucata* to the rich orange of *Colias edusa* and the orange-red of *G. cleopatra* are all of one genetic significance leading from white to red; and when one traces the derivative coloration of *edusa* through the intermediate forms which connect it with its var. *helice*, and sees the pale primrose of *Rumia crataegata*, lose its colour under the action of the weather, one recognises that they have their origin equally in white. The normally white markings on the forewings of *Arctia caia* are frequently creamy or yellowish in colour, and are not infrequently tinted with red. There is also a tendency in some specimens of *Nemeophila plantaginis* (especially females), for the yellow of the underwings to become deep orange and more rarely red, a progressive development in direct opposition to the retrogressive var. *hospita*. In fact, it is highly suggestive, that whilst *hospita* is a retrogressive variety of our typical yellow form, this is, in its turn, a retrogressive condition of a still more highly developed red form. That the red in the hind wings of *Arctia caia* is directly derived from yellow, may be noticed when the black spots on the hind wings of this species tend to become partially obsolete. The edges of the reduced spots which remain, and frequently the whole area in which the black has been suppressed, are usually filled up, not with red corresponding to the rest of the area of the wing, but with yellow, shading off imperceptibly into the red ground colour. In this instance, I do not think the black is in any way reduced to yellow, but that the area previously occupied by the black scales, which in this species are probably not pigmental has been replaced by pigmental scales, the latter showing their recent development in the less highly developed colour of their pigment compared with the remainder of the area of the wing.

Perhaps one of the most interesting results with an alkali is to get

a direct development of yellow, leading up to the brown in typical *Cænonympha pamphilus*, *C. darvus* &c. Under the action of ammonia, the pale undersides and fringes of these species become very yellow and lead insensibly into the normal brown coloration. It would seem, therefore, that the general action of alkalies, in this direction, is to develop progressive coloration—white (pigmented) to yellow, and yellow to red, whilst Mr. Coverdale wrote in 1886, that “a great many acids (hydrochloric, nitric, sulphuric &c.), restored the pigment, when thus changed, to its natural colour.” Whilst dealing with this relation of brown and yellow, I would notice, that the dark brown edging to the anterior wings of *Epinephele tithonus*, *Cænonympha pamphilus* var. *lyllus*, and their allies, is much more readily acted on than is the orange colour in this species, which is rather remarkable when the colours are considered in their genetic relationship but is not at all so from a varietal point of view. The unstable character of this band is very marked, and only occurs occasionally in certain varieties of some species although it is quite constant in others. Here then, we notice that a colour in a condition of transition or formation, may be, and probably is, more unstable than the colour from which it springs, although the latter, genetically considered, is of course lower than the former. Such a case, is found in *Callimorpha hera*, the red form of which is changeable readily to yellow, the normal colour of its var. *lutescens*, and, at the same time, is itself rather more readily reduced completely to white than is the yellow variety before mentioned. The dark brown of *Thanaos tages* is of the same unstable character, and it is probably quite a recent offshoot from the more yellow brown of its allies in the genus *Hesperia*. The transitional and unstable character of the darker colour in *Epinephele* and its allies, gives a decided proof of their probable recent development. The brown found in those varieties of *Angerona prunaria* in which the bright orange is reduced to a small patch in the central area of the wing, is also of a very unstable nature and easily affected; not so the orange which is particularly stable. I had often wondered what was the cause of the peculiar glossy appearance noticed in some species such as *Satyrus semele*, but have proved that this is superficial and not due to the normal pigment, as it remains after all the pigment is artificially bleached from the wing.

Put of the direct retrogression of red and brown forms to yellow, we have numerous examples. There are yellow varieties of *Arctia caia*, *Callimorpha hera*, *C. dominula*, *Zygæna filipendulæ*, *Z. trifolii*, *Z. loniceræ*, all tending to show retrogressive development. Cases of *Catocala nupta* with the hind wings also partially yellow are of the same kind. I consider that brown and red are essentially only one colour, and hence we find in another direction, that the yellow tends to brown. It follows, therefore, that normally brown species will have yellow varieties, and *vice versâ* if the tendency of the coloration is in that direction. No species appears to illustrate this so well as the common sexually dimorphic *Odonestis potatoria*. The ♀'s of this species may for convenience be called yellow, whilst the more highly developed males are brown, but I have in my cabinet a brown female and a yellow male, and there are many others on record, and both the yellow and brown readily fade to white. Following out the development in this direction we find that *Bombyx quercus* offers a similar and parallel instance, the females again being yellow, but the males of a

more decidedly red-brown. Another close connection exists between yellow and the purplish-brown of *Lasiocampa quercifolia*, as I have a yellow variety of this species.

I would also add, in connection with the change from red to yellow, a remarkable circumstance, first made known to me some years ago by Mr. Coverdale, that is worthy of notice, *viz.*, that although several reagents will turn the red of the various *Zygænidæ* and their allies, yellow, a careful washing with water, and even long continued exposure to air, will in some instances restore the colour. This, of course, only occurred in a very limited number of reds, the greater number being altered quite permanently. I was interested to see that Mr. Coste had lately noticed the same phenomenon.

There is another colour which the study of variation explains very considerably. I refer to grey. Sometimes grey is the result of a pure black and white surface absorption and reflection respectively, and is then probably produced without any pigment. But there is another form of it sometimes called stone-grey, ochreous-grey etc., which has a somewhat similar superficial appearance to pure grey (formed from black and white), with the addition of the slightest suspicion of ochreous in its composition. That this tint is always in reality a yellow, or has a yellow base, is I think obvious, if we study the variation. This particular phase of coloration is most marked in certain species such as, *Tæniocampa gracilis*, *T. cruda*, *Tapinostola hellmanni*, *Orrhodia erythrocephala*, *Leucania albipuncta* v. *grisea* and *L. lithargyria* v. *argyritis*, *Grammesia trigammica*, *Mamestra sordida*, *Tæniocampa populeti* (an extreme form), *Xylophasia polyodon*, *Dyschorista ypsilon*, *Orthosia lota* (an extreme form), *Cosmia trapezina* &c., and in all these, we find, that these stone-coloured forms have almost always distinctly red, and very frequently both red and yellow varieties, whilst the transition in some of the species just mentioned is continued onwards to deep red-brown and black. I consider the grey of *Lithosia griseola* and its allies identical in character, although the continuation to red does not take place, and the probability is, that if the paler forms of the before mentioned species are now in a state of development, tending in the direction of colour retrogression towards white, the latter must be in a state of development, probably in the direction of colour advancement. Another experiment that strikes me with relation to this colour was an accidental one I made on *Acidalia ochrata*. This species is normally of a deep orange almost brown coloration. Having captured a considerable number, which I could not set immediately, I pinned them into a zinc box in which a few drops of liquid ammonia had been poured. Opening the box shortly afterwards, the whole of the specimens were changed to a pale grey coloration, with the slightest trace of ochreous very much like normal *Acidalia inornata*. Exposure to the air, however, restored the colour entirely, and the specimens were in a short time as richly coloured as ever. Here ammonia effected artificially a retrogressive change, which is very suggestive when we consider that *A. aversata* and its reddish form exhibit in nature, the two colorations which *ochrata* exhibits when treated with ammonia artificially and in its natural condition. It seems certainly a fair assumption that the colour of *A. ochrata* has developed from such a pale shade, and that the red var. of *aversata* is an attempt in the latter species to follow the example of *ochrata*. The intimate

connection between this peculiar grey, yellow and orange, is to be noticed in nature in *Lithosia griseola* and its var. *stramineola*, in the sexual dimorphism exhibited by *L. quadra*, and in the many different varieties of *L. pygmaeola*. All these show their direct derivation and are very unstable. I have a perfectly white (bleached) female specimen of *L. quadra*, and the grey of the male bleaches just as readily.

Among the Nocturæ it is easy to prove the close connection between white, yellow, red and brown. The various species of *Leucania* and *Nonagria*, whatever their typical colour in England, almost invariably exhibit this range. For example, I have *Leucania pallens* and *L. straminea* running from pure white, through ochreous, to deep red, and there is a red tinge on certain specimens of all the species, and sometimes this culminates in deep red-brown as in varieties of *Nonagria arundinis*. The deep red (in England) of *L. turca* becomes normally yellowish in Japan, and so on through many other species. The yellow streak in *Orthosia macilenta* is frequently red, and some of the dark chestnut coloured varieties of *Orrhodia ligula* (*spadicea*) and *O. vaccinii* have a broad subterminal band of yellow which is frequently merged in the ground colour, the change from yellow to brown being absolute. Similar variation occurs in the subterminal band of *Bombyx quercus*. The almost absolute and identical nature of brown and red, is well illustrated in species normally ochreous and varying to decided red and brown tints as in *Anchocelis pistacina*, *Orrhodia vaccinii*, *Tæniocampa stabilis*, *T. munda*, *A. lunosa*, *Noctua castanea*, *N. festiva* &c., and still more strongly by the interchange of orange-red and brown in the coloration of *Angerona prunaria*. I have also a deep brown variety of *Himera pennaria* and have seen distinctly red forms, whilst the pale ochreous areas in the wings of ♀ *Hemerophila abruptaria* are changed directly into brown in the male, the latter sex again appearing to be the more highly developed form, whilst a pure yellow variety of the normally brown *Odontopera bidentata*, which I possess, would appear to point to a retrogressive condition, whilst bearing out at the same time the general principles involved. I think, therefore, we may safely assume that brown is directly developed from yellow, as also is red, sometimes, but not necessarily, using red as a stepping-stone in this direction of development. *Agrotis cursoria* and *A. tritici* are other species which have distinctly reddish-brown and ochreous forms.

If we wish for a direct proof that brown is convertible into yellow, we have only to treat a number of brown species with hydrochloric acid, ammonia and other ordinary reagents. *Argynnis paphia* and other species of the same genus, *Ctenonympha*, *Satyrus*, *Epinephela* &c., are all more or less rendered yellow, as also are the brown species of *Hesperia* (*sylvanus*, *linea* &c.), and the species of *Melitæa*. Not that these are all acted on uniformly by the same reagent, but some one or other common reagent will reduce the brown to yellow, and frequently dissolve out the pigment entirely. Many of the species of these genera, too, readily bleach to white. I have naturally bleached specimens of many species and artificially bleached ones are frequently met with.

Having noticed the development of yellows, reds and browns, and the repeated instances in which insects normally of one of these colorations develop varieties of the allied colours, we may now trace

the pigmental red and brown to its highest development—black. That the black in many species is readily deducible from red or brown, may be seen in such species as *Pararge ægeria*, *Epinephela hyperanthus*, *Satyrus semele* and *Lycæna artaxerxes* among the *Diurni*, in the black varieties of *Xylophasia polyodon* vars. *infusata* and *æthiops*, in *Bisulcia ligustri* var. *nigra*, *Xylophasia rurea* var. *nigrorubida*, *Apamea didyma* vars. *lugens*, *nigra*, *albistigma* and *leucostigma*, *Helotropha leucostigma* and its var. *albipuncta*, *Triphæna orbona* var. *nigrescens*, *Orrhodia ligula* and endless other *Nocturæ*, in all of which the transition is most marked. Probably no species shows the same perfect range of colour as do *Xylophasia rurea* and *Agrotis tritici*. In both species, the range extends from almost pure white to black with intermediate yellow, ochreous, red and brown forms. Now all these examples of black species are probably pigment blacks, i.e., positive developments of pigmented scales which remain pigmented.

Very different are the cases in which non-pigmental black scales supersede and replace pigment scales. I have a specimen of *Vanessa urticae* with the hind wings purely black, the red pigmented scales being undeveloped, which is probably a case of this kind. We get another change in which a probably unpigmented scale replaces another unpigmented, as in *Amphidasys betularia* var. *doubledayaria*, *Tephrosia biundularia* var. *delamerensis*, *Melanthia rubiginata* var. *plumbata*, *M. albicillata* var. *suffusa* &c., in all these instances black replacing white.

But blacks are very deceptive even in the most closely allied species. Thus the black spots in the hind wings of *Arctia villica*, *Callimorpha hera* &c., are readily changed to brown, the black of *C. dominula* slightly so, whilst that of *A. caia* is most absolutely immovable. But probably the most deceptive black of which I know, is that in the velvety fore wings of *Arctia villica*. This intense colour is only a slight modification of the brown in its ally *A. caia*, and is readily changed into a brown identical with that in the latter species. In the same way, the intense black of *Mamestra persicariae* is only an extreme development of brown, and shows its pigmentary character at once on exposure. Another interesting peculiarity in the development of black came under my notice. As is probably well-known, the black band on the hind wings of *Catocala* is very immovable. In all our species of this genus, it is almost impossible to modify it to any appreciable extent. *Catocala fraxini* appears to offer a peculiarity in the genus in having no coloured base to the hind wings (within the black transverse band), but to be uniformly black to the base of the wing. But if the species be held up before a strong light, and the wings looked through, this black area is distinctly divisible into two as in the remaining species of the genus. The first is a black band, identical with the transverse band, which is normal in the genus, the other comprises the normally coloured basal area. But, although these areas look identical and are practically indistinguishable when looked at from above, yet, holding a specimen to the light shows that the transverse band is opaque, absorbing all the light that falls on it, whilst the basal area is only superficially black, transmitting a great proportion of the light that falls on it and therefore readily capable, we may assume, of becoming pigmented.

Having now run through the first series with regard to genetic development, we have now to deal with the second series. This, as I

stated before, passes through white, yellow and green to red or blue, then to purple and probably black. The retrogressive development of green through yellow is easily illustrated by reference to our British fauna. Almost all our green insects are rapidly affected by ammonia, changing to yellow and in some cases to white. *Halias prasinana*, *Aplecta herbida*, *Agriopsis aprilina*, *Diphthera (Moma) orion*, *Metrocampa margaritaria*, *Hemithea strigata*, *Larentia pectinitaria*, *Lobophora viretata*, *Larentia olivata*, *Tortrix viridana*, *Halias chlorana* and very many others are well known examples of a rapid change to yellow, whilst very weak acids dissolve the yellow as well, and make the insects white. Probably most of the yellow specimens of these species seen in our cabinets are due to the action of the ammonia or cyanide of potassium used in killing them, but yellow varieties of *Tortrix viridana* and partially white vars. of *Halias chlorana* are not at all uncommon. *Halias prasinana* too, rapidly becomes white on exposure to the weather. All these are examples of green undoubtedly derived through yellow, but there is another phase in the development of green which we have to consider. It has before been shown that red and brown are directly derivable from yellow and orange, and therefore there is an intimate connection between green on the one hand, and red and brown on the other. The males of *Halias prasinana* exhibit this very distinctly, and anyone with a fairly long series of this species can readily see the facts. The female of this species is very invariable in colour, being pure green and white, but with the male it is not so. Normally the green is the same as in the female, but the fringes, inner margin, and costal margin of the male, are generally orange and occasionally red. Thus, those parts of the wing which are white in the female, exhibit a development through orange to red, whilst the rest of the wing passes through orange to green, the latter not being evolved from the red nor that from the green, but side by side, as it were, from the same orange base.

I am also inclined to think that many other normally red species, having green forms, have been evolved through the green. One of the most striking instances that I can call to mind is *Ellopiopsis prosapiaria (fasciaria)* and its variety *prasmaria*. This beautiful green variety is not at all uncommon in some parts of the Continent, but it is very rare in Britain. Strange to say, the only specimen of this species I ever saw in the woods at Cuxton, was a beautiful example of this variety, although I have never seen the red type in that locality. In the var. *prasmaria* there is generally a distinct orange costa and pale yellowish-white transverse lines showing the original coloration from which the green has been evolved. In the type, the green parts are red, the orange costa is also red, whilst the pale transverse lines are sometimes green and sometimes shaded with red. There is, therefore, a strong suspicion here that the red has been formed through green, since not only does red in the type replace the green of var. *prasmaria*, but the transverse lines are also sometimes greenish and sometimes red. In *Hyppis sordidata (elutata)*, there would appear to be a similar order of development, and not only do we obtain distinctly green and distinctly red forms, but we get orange intermediates &c. That a great deal of the development in this species is due to "natural selection" appears very obvious, for in our South of England woods almost all the specimens are green, whilst in the Island of Hoy almost all the specimens are

red. At the same time, a very large number of our southern forms show a latent tendency to red, and, in fact, occasionally become red, but under certain conditions of "natural selection." In other words, in certain localities, the red forms are almost entirely absent, whilst in others, with a different environment, the red is almost the only form produced. This species also shows every transition through red and brown to black. Another species showing the upward tendency of green to form red and brown is *Banksia argentula*. Here, the normal green of the anterior wings of this species is frequently developed into a distinct red-brown. An exactly similar tendency is seen in the sexually dimorphic condition of *Smerinthus tilia*, in which species the males are usually more or less green, the females more or less red. The green in normal *Miselia oxyacanthæ* is changed into red-brown in the variety *capucina* and its intermediate forms. *Cidaria psittacata*, *Epunda lichenea*, *Hadena atriplicis*, *H. protea* and others exhibit a similar tendency. These are apparently all direct progressive forms of variation, or they exhibit a progressive tendency, with the exception of *Ellopiæ fasciaria* var. *prasinaria*, in which the normal red develops a green variety, the variety therefore being retrogressive. I have a natural dark brown variety of *Aplecta herbida* (*prasina*), which shows the tendency of green to brown as well as red. Perhaps the parallel development of deep brown and green from yellow, is best seen in *Triphæna fimbria*. The typical coloration in Britain of the fore wings of this species is pale ochreous yellow, a very unstable and easily changed pigment so far as this species is concerned. Reddish-ochreous varieties are not uncommon, and these develop frequently a dark green form known as var. *solani*, side by side with a deep mahogany-brown form (var. *brunnea*), whilst frequently the same specimen is partly green and partly red-brown. No species, I think, shows more distinctly the intimate connection between red and green.

A species, the green of which is closely allied to red, is *Euchelia jacobææ*. Similar as is this species superficially to *Callimorpha*, their pigments are as different as possible, the red of the latter genus having come through yellow, whilst that of *Euchelia* apparently comes through green. Hence the red of *jacobææ* is very soluble as also is its green, but whilst the red is soluble enough in its allies, the green is perfectly unassailable. If *jacobææ* be bleached, the green and red become almost equally pale, and both are quickly reduced to a dirty yellowish or greyish, the red parts differing in no way from the green in colour except that they are a little paler, but no bleaching appears to alter the green of *Callimorpha*.

But I am inclined to suggest quite another origin to the apparent dark green in the upper sides of *Argynnis paphia* var. *valesina*, which obviously owes its development to the same causes as those which bring about the dark females of *Argynnis aglaia*, found in our own moorland districts. Since the normal females of both *A. paphia* and of *A. aglaia* in Britain, show equally a similar but less strongly developed coloration to the typical males, so the var. *valesina* and moorland females of *A. aglaia* show the same further retrogression of colour which becomes excessively pale on the costal and outer margins. At the same time this retrogression in pigment is accompanied by a decided and palpable increase in the development of non-pigmental blackish scales. These, in both species, show a tendency to give a more or less distinctly

greenish tinge, due perhaps to the combined influence of the somewhat ochreous coloration combined with these black scales. The green colour, therefore, is not essentially a pigment colour at all. It is, in fact, almost identical with the gloss on our dark *Pararge ægeria* and in both cases entirely independent of the pigment colour beneath it. The darkening is apparently brought about by a similar action to that occurring in the dark *V. urticae* before referred to. There appears to be no doubt about the origin of the green on the undersides of some of the Argynnids. In *A. aglaia*, a long series of undersides gives every transition between yellow, green and bright fulvous-red, whilst the green in the undersides of *Argynnis paphia* shades off occasionally into the most exquisite pink reflections, and showing an undoubted tendency to produce highly developed unpigmented scale structure. But so far I am very much in doubt about the pigmented character of the green found in the undersides of these species, and although its transitions point it out as such, yet it is not at all safe to assume that it is so.

It is strange that the greens of the undersides of these *Argynnidae*, of *Thecla rubi*, and of the uppersides of the various species of *Procris*, are so readily convertible into brown, and yet we have to look upon them in the light of our present knowledge as probably possessing but little pigment. The mere closure of these species in a damp box changes their coloration to a bronzy or red-brown, the original colour being restored by exposure to the air. If these colours are in any way pigmental, the change is quite regular genetically, but if not, we must suppose that the presence of the vapour which is deposited on the scales, alters the effect produced when the light falls upon them. However, it is at present rather difficult to deal with these colours.

It is easy to speak much more certainly of the beautiful green in the fore wings of *Callimorpha dominula*. In this species the green, I believe, is certainly unpigmented, and it seems impossible to bleach it or alter it permanently in any way. It remains under almost all experiments unchangeable. But a clue to the development of this beautiful green is found in its ally *C. hera*. This species has the dark markings of the fore wings brown, with here and there a superficial metallic gloss. This brown pigment is not at all difficult to remove, and as the pigment gradually disappears, the metallic gloss shows up as a brilliant surface green of the same character as that in *C. dominula*, but of course less strongly developed. The green in these species appears to be unpigmented beyond doubt.

I was always under the impression that the yellow and green metallic markings found in the genus *Plusia* &c., were unpigmented, and was rather startled to find that the pigments were removable, and that the metallic appearance was purely superficial and due to a surface gloss which was entirely independent of the pigment underlying it. Thus I have a *Plusia chrysitis* in which the colour is practically obsolete, but the metallic appearance remains, the ghost of its original self. The pigmented character of these metallic markings was one of the most surprising and interesting facts I have met with in studying the relationship of colour in insects. After I had discovered it, the surprise appeared rather in not having surmised it before, since I knew that the less perfectly developed gloss in such species as *Hydræcia micacea*, *H. nictitans*, the undersides of *Xylophasia sublustris* &c., of *Pararge ægeria* and *Satyrus semele* was perfectly independent of the pigment in these species.

Of the change of green to black we have an example in *Eupithecia rectangularata* var. *nigrosericeata*. This variety is undoubtedly a direct result of "natural selection," and the change is much more positive in the males than in the females, the females becoming a darker and more intense green, whilst the males become black. There is a distinct banded form of *Agriopis aprilina* in which the central area becomes entirely black, and the type of *Moma orion* has the black markings duplicated. There are black forms also of *Hypsipetes clutata* and other normally green species.

As a pigmental colour, blue gives us but few examples, but its unpigmented instances are very numerous. One of the best examples, perhaps, of blue as a pigment colour, is that of *Catocala fraxini*. This is identical in position with, and occupies the place of the normal red and orange bands in the other species of the genus, and appears identical in structure, bleaching somewhat readily like the reds. The purple-tinged specimens of red species, such as *Ellopija fasciaria* ab. *manitiaria* the bands of *Epione vespertaria* and *E. apiciaria* are decidedly pigmental and developed through red, whilst that of *Selenia illustraria* and that of *Lasiocampa quercifolia*, are clearly traceable through the same colour. The blue spots in *Vanessa io* are probably unpigmental and show an advanced development (probably in a difference of scale structure) on the corresponding white spots in *V. urticae* and *V. atalanta*. One of the most interesting blues we have is that of *Agrotis praecox* var. *praeceps*, and since the green of *praecox* is highly pigmental it is probable that the blue of *praeceps* also is. It is the only case I know among our British Noctuae, in which a green pigment becomes changed to blue, although the change frequently occurs quite naturally in the probably unpigmented green of *Zygæna*.

I am rather inclined to think that the blue of *Lycæna* is largely pigmental, and derived like their brown females through red or even white. Certain it is, however, that blue and purple represent the highest development of our pigmental colours. Among the species in *Lycæna*—*corydon* bleaches readily artificially, and the ordinary male then looks identical with the natural white var. *corydonius* found in Spain. A form of the male occurs at Dover with an ill-developed row of spots (normal in the female) on the outer margins of both fore and hind wings, and with a decided white band edging it. Here the blue is distinctly traceable and changeable to white. I have male *L. icarus*, similarly tending to form white (colourless) varieties. These were taken at Deal, in August 1887, which will be remembered as a dry hot summer, in which the larvæ probably had to put up with a minimum of food, and hence there is some suggestion of a connection between this want of food and the ill-developed pigment. At the time I captured these pale males, I also took a female with a white hind wing, and other strange forms. This species bleaches artificially as also does *L. ægon*, and, arguing from analogy, I should suppose most of the species are pigmental. It must be remembered too, that the species of *Polyommatus* have excessively soluble pigments, and the *Polyommata* and *Lycænae* are very closely allied. Put into a damp box the "blues" rapidly change, the bright blue of *bellargus* becomes green, as also do the blues of *icarus*, *ægon*, *corydon* &c., in a less degree. But this is no proof of their pigmentary character, any more than is the change of green to brown under similar con-

ditions in other species before referred to. The beautiful purple of *Apatura iris* and its allies is unpigmented, as may easily be imagined from the fact that the colour is only obtainable when the rays of light strike the scales at a certain angle.

These remarks on the genetic relationship of the colours of our British lepidoptera are not presented as a complete exposition of the subject, but are rather the result of isolated suggestions which the study of variation has now and again presented to me.

THE BRITISH NOCTUÆ AND THEIR VARIETIES.

Class :—NOCTUÆ, Linn.

II. Sub-Class :—GENUINÆ, Gn.

4. Family :—*Noctuidæ*, Gn.

THIS family contains some of the most interesting genera, so far as variation is concerned, viz.—*Agrotis*, *Triphæna*, and *Noctua*. Almost all the species in these genera are massed together in one unwieldy genus, *Agrotis*, in Staudinger's 'Catalog', subdivided into groups which do not agree in any way, with our genera as used in Britain. Among the *Noctuidæ* we have probably some of the most confusing species in the whole of our NOCTUÆ. The species in *Agrotis* are all more or less variable, and in their extreme phases of variation have so many common forms that it seems almost impossible in isolated cases to say to which species certain specimens should be referred. The specific value of *A. aquilina* is still a moot point, but all other British species appear to be well fixed. We find that certain forms of *A. vestigialis* are exceedingly like *A. tritici*, while specimens of *A. tritici* are often very much like *A. vestigialis*; again certain forms of *A. tritici* are almost indistinguishable from similar forms of *A. cursoria* and *A. obelisca*, and *vice versa*, but from the great mass of material that has gone through my hands during the last few years, I have little doubt that these three latter species are distinct enough, although very little is as yet known of them by the great bulk of our lepidopterists, and this will continue until our lepidopterists have a much greater number of specimens for comparison than they usually possess. In the genus *Agrotis*, too, we get certain well-defined groups, which vary much *inter se* and vary also more or less towards the other groups. The hind wings of this genus are worthy of study, but they present so much variation, that no reliance can be placed on shade, colour, or marking, in determining sex. There is a certain amount of sexual variation which reaches its highest point of divergence in *A. puta*, *A. cinerea*, and *A. lunigera*, and these are joined by species, intermediate between them and those species in which this divergence is less striking. The variation in the markings of the superior wings of some species, passes through almost all grades, from total absence (both pale and dark forms) to bright, strongly-marked specimens, and from extremely pallid specimens in many cases, to almost completely melanic forms. I have previously written much about the *tritici-cursoria* group, see 'Entom.' vol. xviii., pp. 94-96, pp. 188-189; and vol. xxi., pp. 171-176, pp. 198-202, but whereas I was at first inclined to consider *cursoria* and

obelisca as sub-species of *tritici*, a much larger amount of material has greatly altered my opinion, and I now consider them quite distinct. The chief points of variation will therefore be dealt with as each species is described. In the genus *Triphæna*—*T. comes* and *T. fimbria* exhibit strong colour variation in the upper wings, whilst in *Noctua*—*festiva*, *glareosa*, *dahlii* and *neglecta* also have a wide range, the Shetland forms of the two former species being very striking.

Rusina, St., *tenebrosa*, Hb.

The type of this species is represented by Hübner's ('Sammlung europäischer Schmet.' &c.) fig. 158, which is a male with "the anterior wings of a rich brown colour with a dark longitudinal shade under the median nervure; two black basal lines before the reniform, orbicular distinct, reniform pale with a dark shade from its lower edge to the inner margin, followed by a strong, dark median shade. Hind wings dark grey, base paler grey, lunule distinct." Hübner's fig. 503 represents a ♀ with the "anterior wings of a rich brown ground colour, with an abbreviated, followed by a complete double transverse basal line, the complete basal line is followed by a blackish transverse band through the centre of the wing, and there is a similar band directly beyond the reniform, the outer area is also darker than the ground colour." The *phæus* of Haworth is a grey form, while his female, which he calls *obsoletissima*, is also "tinged with grey." There is very considerable sexual variation, the females being much smaller and generally more obscurely marked than the males. Our forms from the Southern counties are typical, occasionally, however, an intensely dark, almost unicolorous, reddish-black specimen occurs, but these dark varieties are more common in Scotland.

a. var. phæus, Haw.—Haworth thus describes this form:—"Thorace alisque griseis, strigis 4 denticulatis, punctisque duobus baseos obscuris." "Antennæ pectinatæ, thorax alæque anticæ grisei, punctis 2 baseos oppositis, strigisque 4 undulato-denticulatis æquali spatio remotis fuscescentibus valde obsoletis. Alæ posticæ fuscescentes" ('Lepidoptera Britannica,' p. 133, No. 94).

β. var. obscura, mihi.—With the ground colour of the anterior wings of a deep unicolorous blackish-brown, without distinct markings except the reniform which is outlined in paler. Occasionally found in the South of England but more frequently in Scotland.

γ. var. ferruginea, Esp.—As Guenée says, this "is certainly a form of this species." Esper's Plate 47, fig. 5 ('Die Schmet. in Abbildungen' &c.) may be described as a ♂ of a dark ferruginous-brown colour, with a paler narrow band parallel to hind margin, the stigmata indistinct; a pale spot between the reniform and orbicular; the inner margin at base and centre paler; the hind wings dark grey with the base paler and a darker lunule. His fig. 6 is a ♀, of the same size as the male, almost unicolorous, rather duller and less strongly marked than the ♂.

Agrotis, Och.

The species comprised in this genus have so many differences *inter se*, that Guenée divided them into thirteen groups. Our British species are scattered over eight of these groups. This genus is probably one of the most difficult that we have among the NOCTUÆ so

far as the differentiation of the species is concerned. Most of the species are so polymorphic that it is often very difficult to distinguish the various forms of the same species, and, added to this, we find that many of the species are so closely allied, that it is almost impossible even to distinguish some of the species from each other. This is strikingly the case with regard to *A. tritici*, *cursoria* and *obelisca*. There are, however, some very distinct species which it would be impossible to confound with other species. The genus shows, too, some very striking cases of sexual variation; the difference in the sexes of *A. puta* and *cinerea* being very marked, the females of both these species having been named by various authors as distinct species from the males. In almost all the species, the females are darker than the males, and this difference is especially noticeable in the hind wings. With regard to the range of variation in the colouring of the fore wings, probably *vestigialis*, *puta*, *segetum*, *lunigera*, *corticea*, *cinerea*, *cursoria* and *tritici* exhibit an almost equal range, extending from specimens of the very palest whitish-grey colour (in some of the males) to most intense black in one (the female) or both sexes. It is remarkable, too, that a form of pattern which is constant in one group, becomes an occasional form of pattern in another. The group containing *cursoria*, *tritici* and *obelisca* is probably the most difficult to name and understand of any in the whole of the NOCTUÆ. It has throughout, two well defined forms:—(1) with the anterior wings crossed by a number of transverse lines, and no trace of longitudinal markings, (2) with the transverse lines almost obsolete, being obliterated by the development of pale longitudinal lines, especially along the areas of the costal and median nervures. The former type without longitudinal lines is rare in our British specimens of *obelisca*, although apparently common enough in some European localities. In *cursoria*, on the other hand, this form is the commoner, the longitudinally marked form being rarer (but still not at all uncommon). It is worthy of notice that one species—*ashworthii*—which has long been considered as purely British, has recently been referred by Mr. Dobrée to the more widely-distributed Continental species known as *candelarum*, of which *ashworthii* is considered a melanochoic variety. I have previously mentioned that the hind wings present different variations, and I may add that these are worthy of study, but that no absolute reliance can be placed on the colour of these as indicating the sexes, as it is often assumed may be done. Whether or not some of the species of this group are really distinct, is often questioned by lepidopterists, but there is only one British species so-called—*aquilina*—which I am really inclined to sink as a variety. *Obelisca* and *cursoria* are distinct without doubt, and *nigricans*, another species, about the specific distinctness of which doubt has been expressed, is so abundantly distinct that one almost wonders why doubt has ever been thrown on it, although it must be admitted that some of the obscure forms of *tritici* bear considerable superficial resemblance to certain forms of *nigricans*. Concerning the specific distinctness of these species, an article of mine will be found in the 'Entomologist,' vol. xxi., pp. 171-176 and 198-202 where the matter is discussed at length. I have nothing to add to what is there written, except that I am now more than ever convinced of the complete distinctness as species of *nigricans*, *tritici*, *cursoria*, and *obelisca*, and the certainty that *aquilina* is simply a variety of *tritici*. In dealing

with the varieties of this particular group, I have based my classification (1) on ground colour, (2) on the character of the markings, and have explained this fully in a paragraph preceding my descriptions of these species. Other details, bearing on the variation of particular species, I have noted in my general remarks on the species.

The under wings of some of the species of this genus give us a rough basis on which to group them. Thus *saucia*, *suffusa* and *segetum* distinctly belong to one group; *lunigera* forms a connecting link with *exclamationis*, *corticea*, *puta* and *cinerea*; whilst *ripæ* forms a good connecting link between these and *tritici*, *obelisca*, *cursoria nigricans* and *vestigialis*. On the other hand, the other members of the genus form a heterogenous mass with very little to connect them in any way, so far as the character of the imagines is concerned. The following notes which I wrote in 1889, will show too, how completely the hind wings of some of these species tend to show sexual dimorphism. "*Saucia*.—Male. Hind wings hyaline, whitish-grey, with a dark hind margin; dark nervures; lunule more or less distinct, rarely absent. Female. Hind wings hyaline, darker grey than in the male; distinct lunule; dark nervures (worn specimens show the lunule least). *Suffusa*.—Male. Hind wings hyaline, whitish-grey, with a narrower hind marginal band than in *saucia*; nervures dark; no lunule. Female. Hind wings almost as in the males, but slightly darker; lunule indistinct. *Segetum*.—Male. Hind wings white; no lunule; dark nervures. Female. Hind wings white; with dark outer margin; no lunule, dark nervures. *Lunigera*.—Male. Hind wings pure white; nervures darker, but differing much in intensity; lunule varying from entire absence to being decidedly marked. Female. Hind wings white, with broad hind marginal band; nervures blackish; lunule distinct. *Exclamationis*.—Male. Hind wings white, with faint traces of a marginal band in some specimens; nervures variable in intensity from dark grey to very indistinct; lunule sometimes faint, generally absent. Female. Hind wings dark grey; base slightly paler; nervures darker; lunule generally defined, sometimes very distinct. *Corticea*.—Male. Hind wings variable from whitish-grey to dark grey; nervures slightly darker; lunule variable in intensity but generally distinct. Female. Hind wings dark grey; nervures dark; lunule generally distinct. *Ripæ*.—Male. Hind wings white; nervures slightly darker; lunule indistinct. Female. Hind wings variable in colour, from white to dark grey; lunules generally distinct, but sometimes faint or absent ('Young Naturalist,' vol. x., p. 46).

Agrotis, Och., *saucia*, Hb.

This species offers a moderate amount of variation, some specimens being pale ochreous in ground colour, others very deep reddish-black. Although some of the specimens have the whole of the wing area of the same colour, others have the costal area very dark, others very pale, and there are many intermediate forms. Normally, there are two transverse basal lines, the three ordinary stigmata, and two transverse lines beyond the stigmata, but all these markings are very inconstant. There is also a great deal of variation in the shape, size, and intensity of the orbicular, rather less in the reniform, and the claviform is often very ill-developed. The hind wings are pearly-grey, darker on the

hind margin, and deeper in colour in the females than in the males. Of the general variation of this species, Newman ('British Moths,' p. 319) writes:—"The colour of the fore wings is generally dull-brown, with a strong tendency to become vinous-red on the costa, and sometimes this colour pervades the whole of the wing; but these shades are very inconstant, indeed, the distribution and tint of the ground colour seem very capricious, in some specimens the costal area is almost black, as in the second figure, in others it is pale wainscot brown, as in the third figure." Hübner's fig. 378 ('Sammlung europäischer Schmet.' &c.) represents the type of this species, of which I made the following description:—"The median nervure divides the anterior wings longitudinally into two parts, that above being dark, or even vinous, red-brown, that below dull blackish-grey; these colours extend from the base to the outer transverse line, beyond which, the wing from the costa to the anal angle is pale drab or grey; there is a pale greyish, double, basal streak; orbicular very indistinct, reniform outlined in dull grey; an indistinct wavy line directly beyond the reniform and a transverse line from the costa near the apex to the inner margin, just beyond the anal angle. Hind wings dark grey, paler at base, lunule distinct." The most peculiar point about the arrangement of the colour in this species is, that the costal and inner marginal areas of the anterior wings are generally of different colours, and the colours of these areas are interchangeable, thus, one specimen may have the costal area brownish-grey and the inner margin blackish, while another specimen will have the inner margin brownish, and the costal area black. There seem to be chiefly three different colours in this species, deep red-brown, bright ochreous-brown and greyish-fuscous. The following seems to be the best arrangement I can make of the varieties of this species:—

- 1.—Grey, clouded with ashy = *margaritosa*, Haw.
- 2.—Fuscous-grey, with black costa, = *nigrocosta*.
- 3.—Blackish-grey, with ochreous costa = *ochrea-costa*.
- 4.—Blackish-grey, with vinous-red costa = *saucia*, Hb.
- 5.—Unicolorous red = *rufa*.
- 6.—Red, with pale costa = *æqua*, Hb.
- 7.—Bright brownish-ochreous = *brunnea*.
- 8.—Unicolorous black = *majuscula*, Haw.

α. var. margaritosa, Haw.—Haworth treated this as a distinct species and thus describes it:—"N. alis griseo cinereis nebulosis, stigmatibus tribus ordinariis, subobliteratis, macula apicis pallidiore: posticis fuliginoso-albis tinctura violacei, venis, margineque postico, angulum ani præcipue versus fuscis" ('Lepidoptera Britannica,' p. 218).

β. var. nigrocosta, mihi.—The anterior wings greyish fuscous sometimes tinged with reddish or ochreous, with a broad black shade along the whole of the costal area, sometimes extending far enough across the wing to enclose the stigmata.

γ. var. ochrea-costa, mihi.—The anterior wings blackish-grey with a pale shade along the costa, showing out strongly against the darker colour of the inner marginal area.

δ. var. rufa, mihi.—The vinous-red colouring characteristic of the type of *saucia*, covering the whole of the wings. I have one wholly

red specimen from the Hebrides, much paler than those obtained in the south of England.

ε. var. *æqua*, Hb.—This variety has been described differently by almost every different author, and sometimes even by the same author. The type of this variety is represented by Hübner's fig. 564, which may be described as:—"The anterior wings pale reddish-brown, slightly paler on the costa, an abbreviated and a complete basal striga precede the grey orbicular and reniform which are outlined in black, beyond the reniform is an indistinct transverse row of dots with a pale wavy line near the hind margin. The transverse lines commence on the costa as short black costal streaks, with two others over the reniform. Hind wings dark grey, paler base, dark lunule" ('Samm-lung europäischer Schmet.' &c.). Geyer also figures in the same work, dark brown variety with a pale costa, as *æqua* (fig. 811), also (fig. 812) a deep black variety with a very narrow ochreous costal streak, under the same name.

ξ. var. *brunnea*, mihi.—The anterior wings of a bright ochreous-brown colour, with the transverse lines and stigmata very clearly marked in black. This is perhaps the most clearly marked form of the species.

η. var. *majuscula*, Haw.—This black form is very uncommon in Britain, and I do not remember having seen a specimen of this form. Haworth treats it as a distinct species and describes it as:—"Alis griseo-fuscis vel piceo-nigris, stigmatibus tribus subobliteratis: posticis fuliginoso-albis tinctura violacei, venis margineque postico, angulum ani versus præcipue, nigris" ('Lepidoptera Britannica,' p. 218).

θ. var. *stictica*, Blanchard, in Gay's 'Fauna Chilena,' vii., p. 73, No. 1; Pl. 6, fig. 8 (1854).—This is called a variety of *ypsilon*, Rott., by Butler ('Trans. Ent. Soc. Lond.,' 1889, p. 380) who writes:—"The variety *A. stictica* is the most extreme variegated form of the species." Mr. Butler also mentions another,—"var. *Agr. impacta*, Walker, 'Lep. Het.,' x., p. 337, No. 71 (1856)." It is beyond question that both these are varieties of *A. saucia* and not *A. ypsilon* at all; in fact, they were referred to *saucia* as probable vars., by Mr. T. D. A. Cockerell in a letter to me before Mr. Butler's notes appeared. My own note of this variety (taken from the type in the British Museum collection) is:—"This is a really well-marked variety of *saucia*, much variegated with paler. The basal area of the anterior wings paler, the double basal lines being darker; orbicular whitish, reniform outlined in whitish, with a dark transverse central shade between the stigmata, but just touching the inside of the reniform; outer edge of wing pale from apex to anal angle, the subterminal and elbowed lines distinct and double; costal margin paler. Hind wings dark grey with a paler base." The original diagnosis is as follows:—"Spalotis stictica. Pallide luteo-cinereascens; alis anticis concoloribus nitidis, atomis obscurioribus adpersis, maculis ordinariis vix distinctis; posticis albidis, apice cinerascens." "Coquimbo" ('Fauna Chilena,' p. 73).

Besides var. *stictica*, the following American varieties of *A. saucia*, the types of which I have examined in the British Museum collection, have also been described.

α. var. *differens*, Walker ('Lep. Het.,' x., p. 337).—This is described as follows:—"Male. Ferruginous-brown. Antennæ minutely setose.

Thorax with whitish hairs hindward. Abdomen pale brown, whitish towards the base. Forewings with paler and blackish spots along the costa, and with blackish marginal lunules; all the other marks obsolete. Hind wings white with brownish borders." "Venezuela, from Mr. Dyson's collection."

β. var. *impacta*, Walker ('Lep. Het.', x., p. 338).—"Cinereous brown. Thorax somewhat fawn-coloured and with brown bands in front. Abdomen hoary. Forewings slightly speckled with brown, with indistinct, transverse, double undulated brown lines; claviform spot obsolete; orbicular elliptical, testaceous, nearly as large as the reniform which is formed as usual and is dark brown with a testaceous border; marginal lunules blackish. Hind wings pale cinereous, brownish about the borders." This variety is represented by specimens from "Venezuela and Rio Janeiro." Of *impacta* I made the following note:—"This is a form with the costa paler than the rest of the wing. The ground colour pale reddish-brown; the hind wings of both sexes, comparatively pale, females slightly darker on the outer margin, altogether a very pale form."

γ. var. *intecta*, Walker ('Lep. Het.', x., p. 338).—"Male. Fawn colour. Antennæ minutely crenulate. Abdomen cinereous; apical tuft fawn colour. Fore wings with brown speckles, which are frequently confluent. Hind wings whitish, brownish along the borders." "Monte Video."

δ. var. *ambrosioides*, Moritz. M.S.; Walker ('Lep. Het.', xi., p. 738).—"Female. Reddish-ferruginous. Thorax with a cinereous band. Abdomen cinereous. Fore wings with a cinereous tinge between the discal spots and the anterior border; marginal dots blackish, minute, indistinct; discal spots distinct with deep red borders; orbicular oblong, subquadrate, more than half the size of the reniform which is hardly excavated. Hind wings white with very narrow brown borders." "Venezuela, Bogota."

ε. var. *turris*, Grote.—This is a form in which the ground colour of the fore wings is uniform (no darker costa or inner margin), being strongly tinged with reddish-ochreous and the stigmata grey, otherwise the specimen is very like some of the other pale varieties with uniform ground coloration. It is very like *impacta*, Walker.

ξ. ? var. *texanā*, Grote.—I am in doubt whether Grote's type is really referable to this species, although it appears to be so. The anterior wings are of an almost unicolorous dark fuscous-grey with the basal line and stigmata faintly indicated in darker; the extreme outer margin also darker, the nervures dusky, the ground colour having the appearance of pale longitudinal dashes between the elbowed and subterminal line. Hind wings very white and very little darker on outer margin.

Agrotis, Och., *ypsilon*, Rott.

The type of this species is thus described by Rottemburg:—"Fore wings dark reddish-brown, shaded with black-brown. There are 3 indistinct undulating transverse lines, one of which is near the base, the other 2 in the middle of the wing. Each of these lines consists of 2 dark brown closely united lines. Between the 2nd and 3rd, stands an indistinct round and a kidney-shaped spot, both are lined with black, on the outer side of the reniform is a black streak, and a black

point on the interior side, which gives it the appearance of the point of a black arrow. There are 5 such points on the costal margin all turned towards the base, two of these are rather long, white below but black at the point whilst the other 3 are quite white and much smaller. Below the above mentioned small circular spot lies still a longish black spot, which touches the 2nd transverse line and forms, though very indistinctly, a Latin Y or 2 pronged fork. Yet this mark is not very perceptible. The moth is better known by the point-shaped marks described above. The ground colour is darker in some, lighter in others. Hind wings are white with brown veins, black-brown towards the outer margin, and have a white fringe. This moth does not belong to the NOCTUÆ, but to the BOMBYCES. The antennæ of the male are noted for being not entirely hairy, but smooth at the tips. The moth is of the same size as *Ph. atriplicis*, but the fore wings are rather small" ('Naturforscher', ix., 14). Borkhäuser describes it under the name of *suffusa*, as also do Fabricius and many other authors. The great character of the species is the spine-shaped mark on the outer side of the reniform. The only other species in which I have noticed this development are *Agrotis vestigialis*, in which it is common, and occasional varieties of *A. exclamationis* and *A. tritici*. The species is sexually dimorphic, the female having the central and basal areas of the fore wings much darker than the males, and I have a ♀ specimen in which the outer pale area is white instead of ochreous. The hind wings of the females, too, are darker than those of the males. There are sometimes two, sometimes three, wedge-shaped spots opposite the spine-like processes from the reniform, but many specimens show an almost complete transverse row of these, although many are in a more or less undeveloped state. Haworth describes the male as "*spiniferus*," the female as "*suffusa*." Butler in his 'Synonymic notes on the earlier genera of Noctuides,' makes a hopeless muddle of the synonymy of *A. saucia* and *A. ypsilon**, which he calls the same species, and the two vars. he mentions as belonging to the latter, really belong to the former (*vide*. 'Trans. Ent. Soc. Lond.' 1889, p. 380). Mr. T. D. A. Cockerell writes concerning these varieties:—"The following are probably vars. of *A. saucia*,—*stictica*, Blanch., *punctulata*, Blanch., *impacta*, Walk. and *æthiops*, Phil." (*in litt.*) By reference to the Museum types, I find that *stictica* and *impacta* certainly are.

a. var. *annexa*, St.—Stephens' *annexa* is a small variety of *ypsilon*, but is probably not identical with that of Treitschke. Stephens' description is as follows:—"The fore wings are of a pale brown colour; fore margin and apex pale; the hind portion of the wing dark, and the stigmata united by a black dash; there are numerous short, transverse, dark shadings across the costal part of the wing, and other irregular ones between the base and the stigmata, beyond which is a row of dark spear-shaped dashes and a row of dark points along the apical margin of the wing. The hind wings white, with the outer and anal edge brownish, and a slender dusky apical margin" (Humphrey and Westwood's 'British Moths,' p. 117). Guenée considers Stephens' *annexa* ('Illustrations' &c., ii., p. 117) as synonymous

*Mr. Butler has apparently acted on Guenée's suggestion ('Noctuelles', v., p. 271) and used *Peridroma*, Hb. for the genus, but *saucia* is the type of this genus, not *ypsilon* = *suffusa*.

with Treitschke's *annexa* and gives it as a distinct species "very common throughout North America," whilst he gives *subterranea*, Fab. as a var. of *annexa*, "smaller than the smallest *annexa*, squarer winged, more streaked and sometimes recalling certain varieties of our *aquilina*. From the Isle of St. Thomas and Antilles in the West Indies." He then adds:—" *Agrotis annexa* has passed and still passes among certain entomologists as an European species. M. Boisduval gives it as coming from the Crimea; M. Stephens, as having taken it on the coast of Essex and near Cork. Treitschke has described it as European with doubt. For myself I firmly believe it to be an American species" ('Noctuelles,' vol. v., p. 268). Whether or not *annexa*, Tr. is a purely American species, as seems most probably the case, it is certain that Stephens' British examples were simply small specimens of *ypsilon* and therefore not synonymous with Treitschke's *annexa*. I have some of these small specimens from Deal.

β. var. *idonea*, Cr.—Cramer's *idonea* is referred by Guenée as an American variety of *ypsilon*, and from Guenée's remarks, the specimens appear to vary *inter se*. Guenée writes (var. A):—"The American specimens which Cramer has named *idonea*, vary according to the districts in which they are found, but none appear to offer specific characters. They are generally larger and more decidedly coloured than ours, especially the females, in some of which the basal and median spaces are often entirely black. Those from Columbia have the lower half of the wing of a very pale testaceous, which shows up conspicuously against the brown of the costa and of the cellule" ('Noctuelles,' vol. v., p. 269).

γ. Guenée gives still another variety (var. B) from the West Indies. He writes:—"The specimens from the West Indies, on the contrary, are smaller than ours, a little paler, with the markings less distinct; the black streaks are narrower, and the terminal space is almost concolorous" ('Noctuelles,' vol. v., p. 269).

δ. var. *pallida*, mihi.—With the outer area of the anterior wings of a pale whitish colour without the ochreous colour of typical specimens, otherwise like the type. My specimen of this variety is a female and came from Lewis in the Hebrides.

Agrotis, Och., *segetum*, Schiff.

The type of this abundant species is figured in Schiffermueller's 'Ankündigung eines systemat. Werkes von den Schmet. der Wiener-gegend' (1775), Plate 1. b, fig. 3. The type is figured with "pectinated antennæ; anterior wings unicolorous dark reddish-brown, with a dark shade under the base of the median nervure for about one-eighth of an inch in length, orbicular oblong, scarcely discernible, faintly outlined in a slightly darker shade than the ground colour; claviform more distinct, outlined in darker; reniform pale, ringed with darker, then a pale ring outside this, which is again outlined in darker; a faint, slightly pale, wavy line parallel to the hind margin, a double line near the inner margin just below the reniform (lunular in shape, the concave side turned outwards). Posterior wings white with a bluish tinge and dark nervures." Plate I., fig. 3 is the larva of this very distinct species. This is an excessively variable species both in ground colour and markings and it is, therefore, not surprising that

the early authors treated many of the varieties as distinct species. In ground colour we find intermediate shades from pale whitish-grey and reddish-brown to intense black. In the markings, the variation is based on the suppression or development, and the position, of the transverse lines and stigmata. Normally there are four transverse lines, one, a broken double basal line near the thorax; the second, a double complete basal line on which the claviform is situated; the third, a shouldered (angulated) line just beyond (but occasionally in contact with) the reniform, sometimes this is single, sometimes double (Haworth considered it an important character); and lastly, a wavy line (sometimes modified into a row of dots) quite near the hind margin; occasionally there is a fifth line passing between the reniform and orbicular from the costa to the inner margin, but more generally modified into an oblique shade, extending from the base of the reniform to the inner margin. There is also a great deal of variation in the stigmata; the reniform is sometimes centrally blackish, outlined with pale, and this again outlined in black, others black-centred with a pale outer line only, others simply unicolorous black. The orbicular is sometimes pale grey, outlined with black (this is normal in *lunigera*), sometimes dark grey with a pale outline and again outlined in darker, sometimes it is centrally black, sometimes quite unicolorous; both stigmata are also very variable in shape, especially the orbicular, which varies from a perfectly small circle, to a spot of a longitudinal oval form; some have it almost obsolete in pale varieties, whilst in dark varieties it is often untraceable; the claviform varies very much also. The sexes are abundantly distinct and may be distinguished both by the antennæ and hind wings; the latter are almost pure white in the males but more or less clouded with fuscous in the females. The most important varieties we have appear to be as follows:—

- 1.—Whitish-grey, or pale grey with clear distinct transverse lines and stigmata = *catenatus*, Haw.
- 2.—Whitish-grey, or pale grey with clear distinct transverse lines and stigmata, with broad reddish-brown costa = *segetis*, Hb.
- 3.—Whitish-grey, or pale grey with more or less indistinct suffused lines and stigmata, irrorated and clouded with black = *monileus*, Haw.
- 4.—Clear reddish-brown, with clear distinct transverse lines and stigmata = *segetum*, Schiff.
- 5.—Reddish-brown, with more or less indistinct suffused lines and stigmata, and clouded with black = *caliginosa*, Esp. = *segetum*, Hb. = *sordida*, Haw.
- 6.—Pale grey with reddish tinge, and distinct lines and stigmata = *fuscata*, Esp.
- 7.—Black, with a row of pale dots parallel to hind margin = *subatratus*, Haw.
- 8.—Unicolorous black = *nigricornis*, Villers = *nigricornutus*, Haw.

The following are simply sub-varieties of the former:—

- 1.—var. *pectinatus*, Haw.—A sub-variety of the var. *catenatus*, with smaller claviform and a double angulated line instead of a single one (just beyond the reniform).
- 2.—var. *spinulus*, Haw.—Another sub-variety of var. *catenatus*, with the reniform not touching the elbowed line, and the exterior

striga modified into a row of pale dots.

- 3.—var. *connexus*, Haw.—Another sub-variety of var. *catenatus*, with the reniform and orbicular joined by a double line.
- 4.—var. *corticus*, Haw.—Another sub-variety of var. *catenatus*, with the orbicular denticulate instead of round, and the strigæ partially obliterated.
- 5.—var. *venosus*, Haw.—Another sub-variety of var. *catenatus*, with the veins broadly fuscous.

With regard to the general variation of this species, we read in Humphrey and Westwood's 'British Moths,' p. 116:—"This most variable insect measures from $1\frac{1}{2}$ to nearly 2 inches in the expanse of the fore wings, which are of a brown colour very inconstant in its hue, sometimes being nearly black, and considerably irrorated with darker shades." "The position, form and development of the fascia, beyond the posterior stigma, is very variable, the varieties rising therefrom having been regarded as distinct species; as have also numerous others, produced by the general colour of the wings, the greater or less distinctness of the stigmata and fasciæ etc. The female is darker than the male, and both sexes have the hind wings nearly white with a purplish tint, and with the hind margin and veins dusky, especially in the female." Guenée writes of this species:—"It varies very much without doubt, but not sufficiently to have caused Haworth to create nine different species. It is difficult to classify these different varieties, the intermediate forms being as numerous as the varieties." "I have a specimen from Central India and another from Pondicherry which do not differ from our European specimens" ('Noctuelles,' vol. v., p. 275). The species apparently occurs throughout Asia and Africa.

a. var. catenatus, Haw.—This pale whitish-grey form of *segetum* is a comparatively rare variety. Haworth's description is:—"Alis nitide-griseis, stigmatè reniformi ad strigam moniliformem attingente, alis posticis albis." "Exemplar unicum tantum vidi, *Mas.*" "Præcedenti affinis (*subfuscus*), sed vero differt primo intuitu, *alis posticis* albis nec fuscis. *Alæ anticæ* griseæ fusco et atro paulo nebulosæ. Ad marginem posticum striga e punctis atris confluentibus. Stigma anticum subocellare seu annulare puncto atro pro pupilla. *Alæ posticæ* albæ immaculatæ, margine solo nigricante" ('Lepidoptera Britannica,' pp. 114, 115). My best example of this pale form came from Deal, but the elbowed line, which in my specimen is almost moniliform, is not quite in contact with the reniform, neither do the black spots on the outer margin quite form a continuous striga.

β. var. pectinatus, Haw.—This sub-variety of *catenatus* is described by Haworth as:—"Alis griseis, stigmatè postico ad strigam pectinatam attingente, alis posticis albis." "Exemplaria duo tantum vidi. *Mās*, præcedenti simillimus, differt stigmatè teliformi duplo minore. Striga postica extus pectinata est nec moniliformis. Stigma anticum et *alæ posticæ* ut in præcedente" ('Lepidoptera Britannica,' p. 115). This variety appears to differ only from the preceding in the smaller size of the claviform, and the elbowed line not being moniliform.

γ. var. spinulus, Haw.—Another sub-variety of *catenatus*, with the reniform not touching the elbowed line. Haworth thus describes this variety:—"Alis nitide-griseis stigmatè postico ad strigam posticam non attingente." "Stigmata ordinaria medio atra circulo griseo, atro

terminato. Stigma teliforme atro cinctum; ad marginem posticum striga obsoleta undata punctorum pallidiorum. Alæ posticæ ut in præcedente" ('Lepidoptera Britannica,' p. 115).

δ. var. *connexus*, Haw.—Another sub-variety of *catenatus*, with the reniform and orbicular joined by a double line. Haworth's description is:—"Stigmatibus junctis per lineolam duplicem. Stigmate tertio acuto, lineolam atram exerente ad marginem posticum." "Exemplar unicum tantum vidi, *Mas*, præcedenti valde affinis. Alis nitide griseis sed absque strigis; ad marginem posticum fascia undata atra, quæ ad apicem vix attingat. Alæ posticæ albæ" ('Lepidoptera Britannica,' p. 116).

ε. var. *corticus*, Haw.—Another sub-variety of *catenatus*, with differently shaped orbicular and partially obliterated strigæ. Haworth's description is:—"Alis nitide-griseis strigis oblitteratis, stigmate antico tridenticulato, stigmate tertio acuto." "Præcedente in plurimis convenit sed absque lineola inter stigmata, et absque lineola ad stigma tertium. Stigma anticum extus tridenticulatum est, nec rotundum et integrum ut in præcedente. Exemplar unicum tantum vidi. Maris alæ posticæ albæ" ('Lepidoptera Britannica,' p. 116).

ξ. var. *venosus*, Haw.—Another sub-variety of *catenatus*, with the veins broadly fuscous. Haworth's description is:—"Venis dilatatis fuscis, stigmate postico ad strigam moniliformem non attingente." "Alis nitide-griseis. Stigma anticum subocellare, puncto atro pro pupilla. Stigma tertium valde exiguum. Exemplar unicum tantum vidi. Maris alæ posticæ albæ, margine tenue fusco." *Var. β.* "Magis fusco irroratus, venis minus dilatatis" ('Lepidoptera Britannica,' p. 116).

η. var. *segetis*, Hb.—The type of this variety is represented by Hübner's fig. 146 which has "the anterior wings grey with a broad dark brown costa, reniform and orbicular outlined in pale; an abbreviated, followed by a complete, pale basal line, outlined exteriorly with brown; an oblique shade from costa to inner margin includes the orbicular, a very pale but distinct row of dots beyond the reniform with a wavy line near the hind margin, the space beyond this line whitish."

θ. var. *monileus*, Haw.—This is a suffused form of *segetum*. Haworth's description is:—"Alis griseis atro pulveratis, stigmatibus ordinariis maculæformibus ad strigam moniliformem non attingentibus." "Exemplaria duo tantum vidi, præcedentibus simillima sed magis atro pulverata et nebulosa, stigmatibus ordinariis atris maculæformibus, anticum nec subocellare, posticum nec ad strigam posticam attingens, quæ striga moniliformis est, nec pectinata ut in præcedente (*pectinatus*). Stigma teliforme fere oblitteratum. Alæ posticæ ut in præcedentibus."

ι. var. *caliginosa*, Esp.—Esper's description of *caliginosa* (p. 323) is:—"Alis rufo-fuscis, nigro-nebulosis, stigmatibus atris, superioribus subtus puncto nigro." His Plate 64, fig. 3, represents a dark red-brown variety of *segetum* with the outer margin blackish, transverse lines and stigmata outlined in blackish.

κ. var. *fuscosa*, Esp.—This is a sub-variety of the type, being of a "pale grey colour with a faint reddish or brownish tinge, with a double transverse basal line; no distinct claviform, orbicular and reniform both dark surrounded by pale; an angulated transverse line between the stigmata, the outer margin beyond the outer wavy line

filled in with blackish. Hind wings white," Esper's description, p. 324 is:—" *Bombyx spirilinguis* dorso cristato, alis superioribus fuscis, stigmatibus reniformi maculisque plurimis sparsis, abdomine inferioribusque albis immaculatis."

λ. var. *subatratus*, Haw.—This is one of the common varieties in England. Haworth describes it as:—"Alis griseo-atris, stigmatibus strigisque obsoletissimis, strigaeque recta postica punctorum pallidiorum." "Præcedentibus (*venosus*) simillima sed magis atra seu nigra et minus grisea. Striga versus marginem posticum recta, nec undulata ut in præcedentibus et sequente. Alæ posticæ albæ margine venisque fuliginosis" ('*Lepidoptera Britannica*,' p. 116). This is the more ordinary black form of the species found in Britain.

μ. var. *nigricornis*, Villers (= *nigricornutus*, Haw.)—This is the most extreme form of the species. The diagnosis of Villers is:—" *Bombyx nigricornis* alis superioribus omnino fuscis, antennis nigris." Haworth's description is:—"Antennæ alæque anticæ nigræ, fere sine ullo alio colore; certo situ stigmata fere oblitterata, strigaeque undulata nec recta ad marginem posticum e punctis griseis. Alæ posticæ ut in præcedente" (*subatratus*) ('*Lepidoptera Britannica*,' p. 117).

I have also examined the types (in the British Museum collection) of the following foreign varieties of this species. They are almost identical with some of our British varieties.

α. var. *dividens*, Walker, 'Lep. Het.,' x., p. 342, no. 86 (1856).—This var. according to Mr. Butler, "is a dwarfed, pale female, with pinched-in abdomen and male colouring; it is described as a male" ('*Trans. Ent. Soc. Lond.*,' 1889, p. 376). There is no need to tell British entomologists that there is no such thing as "male colouring," none of the colour varieties are really confined to one sex, the only real points of distinction are the antennæ, anal structure and (to a greater or less degree) the hind wings. The original diagnosis of this form is:—"♂. Fawn colour. Antennæ hardly crenulate. Thorax with a reddish band. Abdomen testaceous. Fore-wings partly reddish, darker in front, with black speckles and with two incomplete transverse undulating black lines; orbicular and reniform spots almost elliptical, pupilled with grey and bordered with black, the former about half the size of the latter; claviform obsolete. Hind wings white." "Port Natal."

β. var. *aversa*, Walker ('Lep. Het.,' x., p. 345).—"♂. Very pale fawn colour. Thorax with a slender brown band in front. Abdomen whitish-testaceous. Fore wings minutely speckled with brown, with indistinct brown marks along the costa, and with brown marginal lunules; spots with incomplete blackish borders; claviform narrow, moderately long; orbicular and reniform with brownish pupils, the former nearly round, rather smaller than the latter which has the usual form; an exterior, almost obsolete, transverse undulating line. Hind wings white, with a brownish line along the borders." "Punjaub."

γ. var. *marginalis*, Walker ('Lep. Het.,' x., p. 339).—The original description of this is as follows:—"♀. Blackish-brown with a cinereous tinge. Abdomen whitish-testaceous. Fore wings with a row of black marginal lunules; discal spots with black borders; claviform lanceolate; orbicular oval; reniform as usual, cilia testaceous. Hind wings whitish, brownish about the veins and along the borders." "South Africa."

δ. var. *obliviosa*, Walker ('Lep. Het.', x., p. 340).—"♂ & ♀. Fawn-colour. Abdomen pale testaceous. Fore wings with blackish costal marks and with double transverse undulating blackish lines; discal spots with black borders; claviform lanceolate, resting on the first band, orbicular oval or nearly round, much smaller than the reniform, which has the usual form; these marks are occasionally more or less obsolete, and especially so in the ♀; a row of black marginal lunules. Hind wings of the male, white; of the female, whitish." "Cape (South Africa)."

ε. var. *correcta*, Walker ('Lep. Het.', x., p. 345).—"♀. Brown, whitish beneath. Abdomen very pale brown, hind borders of the segments whitish. Fore wings dark brown, with black and pale costal marks and marginal lunules; spots like the rest of the wing in colour but with black borders; claviform rather long and narrow; orbicular round, hardly half the size of the reniform, which has the usual shape; transverse lines just perceptible. Hind wings whitish, veins and border brownish." "North India."

ξ. ? var. *ingrata*, Btl.—I have no doubt that the type of Butler's *ingrata* from Yokohama is another variety of *segetum* with a dark costa. I have almost identical British specimens. The original description of the type is:—"♀. Primaries above, dark smoky grey with black-speckled, irregular white internal border; discoidal spots black-edged, a short black dash below the cell; a large whitish patch at base of internal area, two irregular brown-edged white lines* across the basal area; apical third of costa white-spotted, a series of black marginal spots. Secondaries, sordid-white with dusky borders. Thorax pale grey, abdomen brownish-testaceous, whitish at base. Wings below paler, with black-speckled costal area, black discocellular and marginal spots; primaries with whitish internal border, body greyish. Expanse of wing, 1 inch 8 lines." "Yokohama" ('Lep. Het. in Brit. Museum,' p. 27). The ♂ is most distinctly *segetum* of a pale whitish-grey or testaceous colour, with 3 dark stigmata, and the costa throughout its length shaded with dark blackish-brown; the hind-wings white.

Agrotis, Och., *lunigera*, Stphs.

The type of this species is described by Stephens in his 'Illustrations Haust.', vol. ii., p. 113, as follows:—"Fore wings of a rich fuscous colour varied with yellowish, with an angulated black streak at the base united to an abbreviated pale striga; behind this, at a distance from the anterior stigma, is a transverse yellowish waved striga bordered on each side with dusky, and very much angulated towards the inner margin; a similar striga arises from the costa opposite to the posterior (reniform) stigma, and bending outwards, turns rather suddenly to the inner edge, the space between the arch and stigma being yellowish, or dull ochreous-brown; near the hind margin is a pale waved streak, and the margin itself is spotted with black, with a pale griseous line at the base of the cilia; the anterior stigma is dusky towards the costa, and bright yellowish towards the inner margin of the wing, forming a lunule of the latter colour; the posterior stigma is margined anteriorly with black and yellowish,

*These do not appear to be developed in a single specimen named *ingrata* in the Museum collection.

and posteriorly with black; the hind wings creamy white." This description was made from an Irish specimen, but it is rarely one sees such a mottled form. Thanks particularly to Messrs. A. J. and J. Hodges* I have a splendid series of picked forms. The variation runs, as might almost be expected, in parallel lines to that in the allied *segetum*, but reddish forms are excessively rare. The palest forms are very pale, quite whitish-grey, and the darkest forms are most intensely black. The very darkest varieties are, I believe, always females. There are pale males and pale females, intermediate males and females, very dusky males and females, but only the females are ever intensely black. This extreme sexual variation appears to be very characteristic of this part of the genus. There is a great deal of variation in the shape of the usually very pale orbicular and also in the reniform, sometimes the orbicular is a tiny clear circle, sometimes ocellated, sometimes almost linear, whilst at other times it is oval, or even irregularly denticulate; in colour it varies from whitish or yellowish-grey (when it is very conspicuous) to an obscure dark-grey centre surrounded with black, the reniform is generally dark, and irregularly outlined in black and pale grey; the claviform is variable in size and shape but constant in colour, being of the most intense black. In many specimens a dark transverse (from costa to inner margin) shade envelops the reniform. A longitudinal black shade sometimes joins the inner edges of the reniform and orbicular; I have a specimen thus joined on the right side but not on the left. The hind wings of *lunigera* are different to those of *segetum*. In the male they are pure white; nervures darker, but differing much in intensity; lunule varying from entire absence to being decidedly marked, sometimes traces of a hind-marginal shade, and occasionally of an inner row of dots on nervures. In the female the hind wings are white, with a broad dark hind-marginal band; nervures blackish; lunule distinct. I have no specimens irrorated with yellow and thus agreeing with the type. The principal varieties are:—

- 1.—Pale grey, irrorated with yellow, with two transverse basal lines, three stigmata, an elbowed transverse and outer transverse lines = *lunigera*, Stphs.
- 2.—Pale whitish-grey, with a slaty tinge, transverse lines and stigmata as in type, not irrorated with yellowish = var. *pallida*.
- 3.—Like No. 2, but with a dark transverse shade inside of and through reniform, and all outer area of wing beyond elbowed line darker than ground colour = var. *virgata*.
- 4.—The whole area of the wing dark blackish-grey, except the pale orbicular and a small patch between the reniform and elbowed line, which are paler, ordinary transverse lines very indistinct, claviform intensely black = var. *suffusa*.
- 5.—Unicolorous blackish, orbicular indistinct, transverse lines almost obsolete = var. *nigra*.
- 6.—Marked with transverse lines and stigmata as in type, but shaded with reddish = var. *rufescens*.

*I must here particularly thank Mr. A. J. Hodges for a magnificent series of this beautiful species, captured by himself and his brother Mr. J. Hodges in 1888, and given me especially for description, so that our knowledge of the variation of this species should be as fully described as possible in these papers.

Stainton in the 'Manual', vol. I., p. 224, says of *lunigera*:—"grey shaded with red-brown." This is a most rare development, I have only two specimens thus tinged, but I believe Mr. A. J. Hodges has other specimens. Guenée writes of this species:—"This *Agrotis* partakes at the same time of the characters of *segetum* and *exclamationis*. It is closely allied to *trux*, and, although it appears to have a very different shape, I should not like to affirm that it will not be recognised at some future time, as simply a northern form of this species" ('Noctuelles', vol. v., p. 280). Guenée's var. **A** appears to me a variety of *segetum* similar to one I recorded from Deal ('Entomologist', vol. xviii., p. 95) as *lunigera*.

a. var. pallida, mihi.—Anterior wings pale whitish-grey with a slaty tinge, with an abbreviated, followed by a complete double basal streak, distinct black claviform, orbicular very pale surrounded with black, reniform of ground colour surrounded with black, a faint wavy line beyond reniform and a slight shade parallel to hind margin. Hind wings white. I have seen no females of this variety. This would be apparently Guenée's var. **A**., if it really be this species, of which he writes:—"Of an almost uniform clear grey, which renders the stigmata more than usually distinct and the markings clearer." Locality: "Scotland" ('Noctuelles', vol. v., p. 280).

β. var. virgata, mihi.—Anterior wings pale whitish-grey, with two basal lines as in the last mentioned variety, orbicular clear surrounded with black, the reniform included in a dark transverse shade extending from the costa to the inner margin; all the outer area of the wing beyond the elbowed line dark fuscous. This variety occurs in both sexes.

γ. var. suffusa, mihi.—The anterior wings with the whole area dark blackish-grey, except the pale orbicular and a small pale patch between the reniform and elbowed line which are slightly paler, transverse lines indistinct, claviform and outline of reniform intensely black. Hind wings of males almost as dark on outer margin as in females. The variety occurs in both sexes but very rarely in the male.

δ. var. nigra, mihi.—Anterior wings unicolorous blackish, with black transverse lines and stigmata absorbed in ground colour, sometimes orbicular faintly noticeable. I have seen this extreme variety only in the female, and it is rare even in that sex.

ε. var. rufescens, mihi.—Another very rare variety of this species, with the markings, stigmata, &c. as in the type, but the ground colour tinged throughout with reddish. This is a very rare variety in Britain although Stainton in the 'Manual' says of the species "tinged with reddish-brown."

Agrotis, Och., *vestigialis*, Rott.

This species is exceedingly variable both in ground colour and markings, although between the extreme forms every intermediate variety occurs. Some of the specimens are almost pure white in colour, others grey, others deep reddish-brown, others black. The characteristic markings of this species are, a longitudinal basal streak, a double transverse basal line (incomplete) on which is situated the claviform, the elbowed line directly beyond the reniform and another wavy line parallel to the hind margin; a series of wedge-shaped marks are situated on this last line, the orbicular and reniform are generally well

developed. All these markings, however, pass through every possible gradation from almost total obliteration to an extraordinary clear development. Thus the claviform often becomes a deep black streak across the wing below the stigmata, the wedge-shaped spots become linear markings extending from the elbowed line to the outer margin of the wing, and so on. The reniform and orbicular vary in size, shape and position, occasionally being in contact with each other. The *vestigialis* of Hufnagel is unrecognisable, but Rottemburg thus defines the species:—"This moth has, as I believe, never been described except by Hufnagel. The ground colour of fore wings with some is whitish-grey, with others whitish-brown. Hind wings are dirty white, towards the outer margin ashy-grey. Its marks of distinction are difficult to describe, but the principal ones are the following. Close to the base of the fore wings is a very short but strong black line, after this follows, more towards the middle and the inner margin, a long dark brown spot, convex towards the tip, but enclosed in a black hook towards the base. Next to this stands a very small oval spot, which is white, but lined with a black line. Close to this, nearer the tip, is a large kidney-shaped spot, which is dark brown in the middle, white on the margin, and surrounded by a black line. Then follows a row of dark brown lines, which runs parallel with the outer margin and represent an interrupted band. The moth is the same size as *Ph. chrysorrhæa*" ('Naturforscher,' viii., 107).

Vieweg's *vestigialis* is the same as the type. His description is:—"Alis incumbantibus cano fuscoque variis: litura baseos strigisque longitudinalibus atris ad marginem posticum" ('Tabellarisches Verzeichniss' &c., No. 30). There is a great deal of variation in size, some specimens being exceedingly small, not so large as average-sized *A. puta*. With regard to the variation in size and colour Mr. Gregson writes of the Lancashire specimens:—"I have selected a long series varying in size from less than an inch in expansion to 1 inch $6\frac{1}{2}$ lines, and in colour from light drab to rich pinky-brown, and also to deep rich dull brown." The specimens can chiefly be classed as coming under the head of whitish-grey, greyish-fuscous, reddish-brown, or black, and in each there are two forms,—one, in which most of the markings are obsolete, and the ground colour obscured; the other, in which the markings are well developed. Many of the specimens are slightly tinged with ochreous and occasionally some of the specimens are tinted with delicate reddish. We thus get the following forms:—

- | | | |
|------------------------------|---|--|
| A. Whitish-grey or pale-grey | { | 1.—With distinct markings = <i>vestigialis</i> ,
Rott. = <i>valligera</i> , Fab. |
| | | 1a.—With the cuneiform marks extended
to outer margin = sub-var. <i>lineolata</i> . |
| | | 2.—With more or less obsolete markings
= ? <i>signata</i> , Bdv. |
| B. Greyish-fuscous | { | 1.—With distinct markings = <i>sagittiferus</i> ,
Haw. |
| | | 2.—With more or less obsolete markings
= <i>trigonalis</i> , Esp. |
| C. Pale reddish-ochreous ... | | 1.—With distinct markings = <i>clavis</i> , Esp. |

- | | | |
|------------------------------|---|--|
| D. Brownish or reddish-brown | { | 1.—With distinct markings = <i>valligera</i> , Bork.
1a.—With basal-half brown = <i>valligera</i> , Hb.
2.—With more or less obsolete markings = <i>brunnea-obsolata</i> . |
| E. Blackish-fuscous | { | 1.—With distinct markings = <i>nigra</i> = var. B, Guenée.
2.—With more or less obsolete markings = <i>nigra-obsolata</i> . |

? *a. var. signata*, Bdv.—This would, according to Guenée, be a pale variety of *vestigialis*, with markings almost absent. I have specimens from Deal in which the markings are practically undeveloped in the palest forms. Guenée thus writes of *signata*:—"The unique specimen of this supposed species, which had been taken at Alsace according to De Villers, has been destroyed, and the *Noctua* has not been found since. M. Boisduval himself now thinks that this *signata* was only a pale variety of *valligera*. I cannot myself form an opinion, never having seen the specimen in question" ('Noctuelles', vol. v., p. 264).

β. var. sagittiferus, Haw.—This is probably the commonest form in England, being of a greyish colour, much suffused with fuscous, but with the darker markings standing out conspicuously. Haworth thus describes this dark grey form:—"Alis griseis fusco nebulosis, costa fusca punctis griseis, strigaeque postica punctorum sagittatorum." "Affinis *Bombyx gramineo*, et duplo major. Maris antennæ pectinatæ griseæ. Alæ anticæ griseæ fusco aliquo nebulosæ, stigmatibus ordinariis, anticum parvum ocellare, punctulo nigro pro pupilla, iride late albida nigro cincta; stigma posticum magnum reniforme nigrum albo nigroque cinctum. Stigma tertium maximum claviforme fere ad basin alæ attingens sed aliquo interruptum. Versus marginem posticum striga undata punctorum sagittatorum, ciliisque immaculatis." Haworth also mentions a sub-var. *β.*, which he describes as:—"ciliis fusco punctatis" ('Lepidoptera Britannica,' pp. 118-119, No. 66). This form is really a development of the paler type, the type having a tendency to be more of a whitish ground colour, this to become darker grey, the females have sometimes a tendency to exhibit a greenish tinge, owing to the presence of ochreous scales mixed with the grey or fuscous ground colour. This form seems to be common in all British localities.

γ. var. trigonalis, Esp.—Esper's *trigonalis* is described by him ('Die Schmet. in Abbildungen' &c., p. 382) as:—"Alis deflexis cinerascens fascia macularum trigonarum, stigmate reniformi fusco, et circinali albo." His fig. 6, plate 75 represents a small male *vestigialis* of a dusky grey colour with duskier outer margin, three wedge-shaped spots, large reniform (dark internally), large dark claviform on the basal line. Hind wings dark grey, darker lunule, and a dark shade parallel to the hind margin. I have received small varieties almost identical with this from Mr. Russ of Sligo, and Mr. T. Baxter of S. Anne's-on-Sea. Guenée says of it:—"Very small, almost white, the claviform large and well developed, the outer edge darker" ('Noctuelles,' vol. v., p. 263).

δ. var. *clavis*, Esp.—“This has the ground colour of a clear reddish-brown, almost ochreous, with a black line on the extreme outer margin, then a row of seven wedge-shaped spots, followed by a large reniform, black centred and surrounded with a black line, the reniform and orbicular joined by a short dusky shade, with a double transverse line (the lower half of the elbowed line) from the lower end of the reniform to the inner margin, a transverse basal line with the black claviform situated on it; quite at the base is a short longitudinal line. Hind wings grey with darker margin and lunule” (‘Die Schmet. in Abbildungen’ &c., Plate 63, fig. 5). I have the clear ochreous-brown form from Spurn, in Yorkshire, Sligo (where it appears to be a common form) and Deal (where it is very rare); the brown forms at the latter locality, being generally much darker than Esper’s variety.

ε. var. *valligera*, Bork.—The colour of the anterior wings of a deep, rich mahogany-brown, with very distinct markings. This is a very intense development of the var. *clavis* of Esper. The females are rather darker than the males. Borkhausen writes of it:—“Ground colour of anterior wings dark brown, much clouded with darker brown, ashy-grey in centre of wing. Hind wings ashy-grey or whitish with darker band and lunule” (‘Naturegeschichte’ &c., p. 551, No 224). This is the common brown form at Deal, where it is, however, much rarer than the greyish-fuscous forms. I have also a male of this variety from Spurn.

Hubner’s *valligera*, as figured in his ‘Sammlung europäischer Schmet.’ &c., fig. 170, is a sub-variety of Borkhausen’s *valligera*, with “the basal half (to beyond the reniform) dull brownish, a black spot in the centre of the basal line is the only remnant of the basal streak; the claviform, orbicular and reniform dark grey, outlined in darker; a wavy elbowed line beyond reniform, with 6 cuneiform spots standing on the subterminal line, the latter having two reddish blotches between it and the outer margin of the wing. Hind wings grey with pale base and distinct lunule” (‘Sammlung europäischer Schmet.’, fig. 150). It will be seen that this is somewhat intermediate in colour between the *sagittiferus* of Hübner and the *valligera* of Borkhausen.

ξ. var. *obsoleta*, mihi.—This variety has all the markings more or less obscured, owing to the duskiess or increased depth of the ground colour. Esper’s *trigonalis* is really the obscure grey form, there are also an obscure reddish-brown form and another blackish-brown.—(1) *Brunnea-obsoleta*. This has the ground colour of a deep dusky brown with a reddish tinge, with the markings obscured by the ground colour, although all are present; thus giving the specimens a more suffused or unicolorous appearance.—(2) *Nigra-obsoleta*. Another sub-variety, with the ground colour blackish-grey instead of brown, although occasionally there is the faintest tinge of brown present. It is advisable to notice that the most obscure specimens have a pale longitudinal area about the median nervure.

μ. var. *nigra*, mihi.—The anterior wings dark blackish-fuscous, except a rather paler area along the median nervure, and the transverse lines which are dusky-grey in colour. The reniform and orbicular are included in the dark area of the costa, and thus form a large costal blotch; in some specimens the area round the claviform is intensely dark, and this makes another large black blotch, thus making,

as it were, a dark central band broken across its centre by the pale median nervure. This is probably Guenée's var. β , of which he writes:—"Large, of a deep greyish-black slightly tinted with brown, with all the typical areas and markings of an obscure ashy colour. The basal spot alone yellowish. The inferior wings entirely of a deep greyish-black in both sexes." He then adds:—"This beautiful variety which one might easily mistake for a distinct species, if one had not before him a large number of specimens, has been reared from the same caterpillar as the type, by Mr. Anderregg of Gamsen. It is designated wrongly, in the Paris collections, under the name of *trigonalis* of Esper, which is exactly opposite to it in colour and markings" ('Noctuelles,' vol. v., p. 263).

θ . sub-var. *lineolata*, mihi.—A sub-var. of the type occurs, in which the wedge-shaped or cuneiform dashes extend outwards to the hind margin of the wing. I have such specimens from Sligo, Deal and the Breck District (where they were captured by Mr. W. Farren). All mine are grey or greyish-fuscous in colour, but whatever the ground colour, I would include such sub-varieties under the name of *lineolata*.

Agrotis obelisca, *cursoria*, and *tritici*.

Some few years ago, when I first began studying local variation, the *tritici-cursoria-obelisca* group of the *Agrotidæ* presented so many difficulties, that, for a long time, I could make but little headway. I had received local forms of *tritici* from different correspondents as *obelisca* and *aquilina*, and had consequently formed opinions based on these specimens. During the first few years I stayed at Deal ('82 and following years), I worked continuously at the NOCTUÆ, and got together a series of specimens which I was convinced were all one species, but which satisfied my correspondents' ideas of *tritici*, *aquilina*, *obelisca* and *cursoria*. Newman also, in his 'British Moths,' p. 329, looked upon *cursoria* as a Kent coast species, so it was no wonder I got into a muddle, and in the 'Entomologist,' vol. xviii., pp. 94-96, I put my trouble in print and stated, most decidedly, that I believed our Southern *tritici*, *aquilina* and *obelisca* to be only different forms of one species, keeping, however, certain forms distinct under the name of *cursoria*. This paper of mine produced some discussion in the same volume of the 'Entomologist,' and led me to correspond with several Continental lepidopterists who kindly interchanged specimens with me. I very soon found that my "very decided opinion" was right, and that (so far as I understood the species) all our Southern specimens were one species, but I discovered that the so-called *cursoria* of our Kent coasts was nothing of the kind, neither was our Kent *obelisca* that species; but having at last strictly defined the different species, I was able to proceed satisfactorily. It appears to be no wonder that many had been misled, for some of our leading NOCTUÆ lepidopterists stated, that they had never seen anything like some of the beautiful forms of *tritici* I had obtained, and I sent a large number also to the Continent, where they were at once referred to various named varieties of different authors. The Perthshire and Berwick lepidopterists in the North, and Mr. A. J. Hodges in the South of Britain, have distributed a very considerable number of true *obelisca* during the last few years; and first, Mr. Percy Russ from Sligo, and afterwards, the Aberdeen col-

lectors, obtained large numbers of fine varieties of *cursoria* for us, besides those obtained by the professional collectors in Shetland. The Welsh and Liverpool coasts have also produced some numbers during the last few years. This has given us material for study, which does not seem to have existed for the last quarter of a century at least, and perhaps not then. Most of our varieties of this group are highly prized by Continental collectors, and one of them remarked to me that "it was impossible to imagine how much some, apparently very constant, Continental species did vary in Britain." Having, therefore, altered my original opinions very considerably, I entered into the discussion of these species at length ('Entomologist,' vol. xxi., pp. 171-176 and pp. 198-202), and not only pointed out the differences between these species, but also dealt with the great general phases of their variation, as based on the presence or absence of a "pale costa" in each species. The conclusions I then arrived at, I am now perfectly satisfied are correct, and there is not the remotest doubt that *tritici*, *cursoria* and *obelisca* are thoroughly distinct species, and that *aquilina* is simply a variety of *tritici*.

Not only British, but Continental lepidopterists have been inclined to sink the species in this group, as vars. of one very widely variable species. In the 'Entomologist's Monthly Magazine,' vol. xix., pp. 278-279, Mr. W. Warren writes:—"One summer, many years ago, I beat out of some ivy which covered the wall of a garden in this town (Cambridge), a great variety of common NOCTUÆ, and among them numerous specimens of *Agrotis nigricans* and *tritici*, and two each of *aquilina* and *obelisca*. I remember having been much surprised at the time, at the occurrence of the last two species, the examples of which I still possess; but as an explanation, which will most likely equally surprise most of those who read it, I send the following notice, translated from the 'Jahrbücher des Nassauischen Vereins für Naturkunde,' xxxiii-xxxiv, 1880-1881, p. 87. Perhaps some of our English entomologists may be able to corroborate the truth of a proposition, which, so far as I can find, has never yet been ventured here, that *nigricans*, *tritici*, *aquilina* and *obelisca* are all variant forms of one and the same species." Mr. Warren then adds the translation referred to:—"A. *tritici*, L., is certainly the most variable of all our NOCTUÆ, in size, markings, and colour; nay, even the antennæ seem not to be quite the same in all examples. We had an opportunity of assuring ourselves on this point very completely. The devastation caused in vineyards on the frontiers of Moravia, recorded by Treitschke in vol. x., pt. 2, p. 19, of Ochsenheimer's work, has been repeated in our neighbourhood, at Ockelheim, near Bingen, in the years 1871 and 1872, to such an extent, that many individuals had their vineyards destroyed. Hundreds of larvæ were collected here in both years, of which the following description was taken:—"Very much like those of *segetum*, averaging an inch in length, yet very unequal in size, cylindrical, stout in proportion to their length; colour, that of the surface of the ground, sometimes lighter, sometimes darker, varying from dirty whitish-yellow to dark red-brown and yellow-brown. Head semicircular, light brown, with two dark lines; on the crown, a collection of black spots. Plate on second segment black-brown, with a central line and two side lines paler. Dorsal surface always lighter than that of the sides, in which respect there exists a likeness to the larvæ of the *Caradrinidæ*. Dorsal

line dark, divided by a pale line. Beneath the dark, straight, broad, sub-dorsal line, there is indicated another fine lighter line. The blackish-brown spiracles stand on the border where the dark lateral and the pale ventral colours unite. Obliquely above and under each spiracle is a black-brown, horny, raised spot; these spots, like the plates on the second and anal segments, are weapons of defence for the larvæ when forcing their way into the ground; and there are others besides, in the place of the spiracles on the first segment, in the middle of the back, on the sub-dorsal lines, perpendicularly above and beneath each leg; and on the lateral edge, the spots, like the head, are beset with short bristly hairs.' The larvæ lived exactly like earthworms, by day, underground, and by night only, on the surface, in order to feed. Salad and such like succulent plants were more relished by them than the tenderest shoots of the vine. The pupa, which possesses an extremely thin shell, lay in an earthen cocoon. Dr. Pagenstecher bred a large number of the larvæ with the same results as myself. I have already given an account of my first brood in the 'Jahrb. des Nass. Naturvereins' for 1871-1872. Later on, the larvæ had again disappeared, without any human means having been of any avail against them. In September, occasionally, a few pass through their stages, and appear in the perfect state as rather smaller specimens than those of the first brood; but the large majority hibernate as larvæ. The perfect insects conceal themselves by day in earth, in deep crevices of the bark of trees near to the ground, in chinks of stones &c. Among the large number of examples reared in the course of these broods, there were those figured by Hübner as *fumosa*, fig. 153, *aquilina*, 135, *obelisca*, 123, *fictilis*, 479 and 710, *unicolor*, 544, *eruta*, 623, *carbonea*, 700, *praticola*, 567, *vitta* and *aquilina*, 533-535, *ruris*, 416; besides the following figured by Herrich-Schäffer—*adumbrata*, 121, *rustica*, 495, *fumosa*, 526, *tritici*, 527 and 552, *obelisca*, 529 and 553. All were plentifully represented, and it could not but be that all belonged to one and the same species, united as they were by numerous intermediate forms. Among them were several forms, especially of *fumosa*, of a beautiful lilac tint, which, however, faded into grey in the course of a year. One *obelisca* was entirely lilac-coloured without markings, with a white costal streak. Of varieties collected at the same time by night, there are besides to be mentioned a pale-yellowish example devoid of markings, with perfectly black outlines of the stigmata; and one found by Dr. Schirm, leaden-coloured throughout without markings on the fore-wings, of which only the margin of the reniform stigma is indicated by a black spot. It is not improbable that there are, besides, other nearly-related forms not occurring here, which now pass as separate species, that likewise belong to *tritici*. The insect is a native not only of the district of the so-called European fauna, but, along with many others of our species of *Agrotis*, of North America also" ('Jahrbücher des Nassanischen Vereins für Naturkunde', xxxiii—xxxiv., 1880-1881, p. 87. 'Die Schuppenflügler des kgl. Regierungsbezirks Wiesbaden und ihre Entwicklungsgeschichte,' von Dr. Adolf Rössler). It is of course quite possible that these were all variable forms of one species, with varieties resembling true *nigricans* and true *obelisca*, or, on the other hand, there may have been all these species mixed up from so many larvæ, for it must be remembered that these specimens were bred from larvæ taken at large, and as I do not for a

moment believe in the specific identity of *A. tritici*, *nigricans* and *obelisca*, although I do in that of *A. tritici* and *aquilina*. I would also point out that the breeding of these common species from larvæ with similar habits does not at all suggest that such were from the same eggs, and until the forms now recognised as distinct are bred from eggs laid by one female, we shall not be able readily to prove their specific identity. Besides, in Continental works, different varieties of *tritici*, wrongly of course, get all the names of the allied species due to the parallel variation in that species.

This group of Lepidoptera, as I have just pointed out, presents, and always has presented, such a vast range of variation and consequent difficulty of determination, even to our best lepidopterists, that it seems only natural they would from time to time, have something to say concerning such a difficult subject. It seems to me, however, that the study of the type-species of these different forms, is very necessary to enable us to get any knowledge of what is really meant by these species, or to find how far our ideas agree with or differ from the intentions of those lepidopterists who named these species.

In the following remarks I have entirely neglected the consideration of *A. nigricans*, because, in all its varietal forms there is no doubt about the species, and even in its most extreme varieties it is not likely to be mistaken for anything else. I will simply add that the dark Scotch form is the Linnæan type (its name suggests it); our Southern specimens are a mixture of var. *fumosa* (dark with a yellow spot), *ruris* (the red form), *obeliscata* (with a dark rectangular spot between the stigmata) and *marshallana* (beautifully marbled with yellow); the two former generally occur in abundance, the two latter more rarely; in fact, the last is an excessively rare variety.

Agrotis tritici.—The type of this species was described by Linnæus, 'Systema Naturæ,' No. 320, as:—"Noctua spirilinguis cristata cinerea alis maculis, duabus pallidioribus unaque nigricante. Stigma ovale et reniforme ut in reliquis juxta ovale internis macula nigra ejusdem magnitudinis similis *Ph. graminis*." This reference to *graminis* makes it quite clear that the type was striated, that is, it had a streaked costa and pale median nervure, together with a row of wedge-shaped markings paralld to the hind margins, these all being constant characters of every variety of this species. In addition, we learn that the colour was cinereous, that the two ordinary stigmata were pale, the claviform black, and that there was a black spot of equal size just within the orbicular stigma. Taking all these things into consideration, there is little difficulty to fix on a type; the colour, as before mentioned, is cinereous, and we have only to imagine a specimen of such a colour, with all the characteristic markings, to settle the matter. The first figure in Newman's 'British Moths' would fulfil all the conditions. So much for the type.

A. aquilina.—Hübner's figure 135 represents the type of this species, and it may be described as follows:—"Anterior wings of a dull dark brown, with the space beyond the reniform, *i. e.*, between the reniform and outer margin, darker than the base; also darker brown between the stigmata. The costa and median nervure scarcely paler than the remainder of the wing, and then simply a slightly paler shade of the ground colour. A dark streak runs under the base of the median nervure; the five wedge-shaped lineolæ which

are so characteristic of the typical *tritici* are well developed. Hind wings grey, with a dark marginal line, dark nervures and lunule."

A. obelisca.—Hübner's figure 123 represents the type of this species. It may be described as "of a deep, dull, reddish colour, with ochreous costa and dark hind margin, well-marked stigmata, but no wedge-shaped marks near hind margin. Hind wings white, with a reddish hind margin."

The above three species are what I may term the characteristic "pale costa" part of the group.

A. cursoria.—The type of this species is thus described by Hufnagel:—"Yellowish-grey, with two brown curved and toothed, and two grey transverse lines" ('Berl. Mag.', iii., p. 416), and is not quite represented by Hübner's figure 540. In the latter, the anterior wings are almost entirely like the figure of *cursoria* in Newman's 'British Moths,' p. 329, but perhaps appear a trifle narrower. It may be described as "of a pale reddish-ochreous, with an abbreviated, followed by a complete, double, black, basal line; no claviform, but the reniform and orbicular outlined in pale; two short, dark, transverse, costal streaks above the reniform, a faint wavy line from the base of the reniform to the inner margin; a double transverse wavy line beyond the reniform; another wavy line from the apex to the anal angle includes a dark reddish-brown hind margin. Hind wings ochreous, with a dark reddish-grey margin, and reddish lunule". N.B.—There is no trace of a costal streak on the anterior wings in either Hufnagel's or Hübner's *cursoria*.

Such are the descriptions of the type specimens. Now for a few general remarks. It will be seen from these descriptions that the types of *tritici*, *aquilina* and *obelisca*, have all a costal streak developed, this costal streak giving a special character to the group. It will be seen that typical *cursoria* has no costal streak or longitudinal markings, but that the characteristic transverse markings are the development and completion of the abbreviated and broken transverse markings in the other group, agreeing with them in every particular; such abbreviation and breaking-up being due to the presence of the longitudinal markings which pass through them. In the species of the first group (with pale costæ), the ground colour has had a great deal to do with their determination by lepidopterists, as distinct species, the brown specimens having been referred very properly to *aquilina*, the dark red and black specimens to *obelisca*, whilst all other specimens have been referred to *tritici*. Those which have had no costal streak have been generally placed together under the name of *cursoria*. Such has been the general method of dealing with these species. To return to the early authors, Hübner only figures one specimen named *tritici*, and that is, according to Dr. Staudinger, a male *crassa*, but he figures three *aquilina*. His figure 135, which I have previously described, is a really good example of the form known as *aquilina* in Britain, but his other two figures of *aquilina*, 535 and 536, are nothing like his figure 135, and themselves represent two entirely different forms. His figure 535 has a yellowish costal streak and a white median nervure, whilst the figure 536 is of a dark red colour with a white costa and white median nervure. Thus we see Hübner figures three distinct *aquilina*, and all three represent different, and not uncommon forms of *tritici*. Unless we are ready to accept all dark brown and red-streaked *tritici* as *aqui-*

lina on the strength of Hübner's three figures, we must throw out all idea of *aquilina* as a species. Boisduval, many years after, described a number of varieties of *tritici*, including some of Hübner's so-called species; but after a few years, Guenée, when writing his 'Noctuelles,' vol. v., p. 289, takes Boisduval to task for referring Hübner's *fictilis* to *tritici* instead of, as he considered to *aquilina*. Thus we find these two great naturalists at variance about the matter, and we find Guenée laying down the law that the type of *aquilina* consists of "those individuals of a pale, clear, brownish ground colour, with the markings, stigmata, and wedge-shaped marks clearly developed." We must, however, bear in mind that afterwards ('Noctuelles,' vol. v., p. 289) he includes *fictilis* and *vitta* as varieties of *aquilina*. To show too, how little faith should be pinned in Hübner's power to discriminate the species of *Agrotis*, it must be remembered that *fictilis* as well as *vitta*, *eruta*, *ruris* and *villiersii* were figured by him as distinct species. Since Guenée, no one, except the British authors, has ever attempted to set up *aquilina* as a distinct species; and no one but British lepidopterists now attempts to prove what seems to me an utter impossibility. I have specimens of the variety from most of those lepidopterists who think they get it. Nearly all the specimens are brownish (as of necessity they must be), all are taken freely where *tritici* occurs; most lepidopterists have a generally correct idea of what *aquilina* ought to be, a few, however, do not seem even to understand these elementary necessities. The Continental lepidopterists long ago understood this question, and Hübner's figure 135 takes its true position in their lists, as the type of *tritici* var. *aquilina*, his figures 535 and 536 being referred to other varietal forms.

With regard to the old British authors, they had a comparatively easy task. Every new form of *tritici* which occurred was described as a new species and named as such. The forms represented by the type-names are difficult to trace, but Wood's, and Humphrey and Westwood's publications have figures of most of these varieties.

The variation of *tritici* is so extreme, that it is almost impossible to give any idea of it. Without egotism, I may safely assert, that I have one of the finest series of this species at present in existence. Some 500 to 600 specimens, picked from perhaps twenty or thirty times that number, include some of the most magnificent forms that can be imagined. The ground colour varies from pale whitish-grey to intense black, but with all this variation there is one thing that immediately strikes a student when a classification or grouping is attempted, *viz.*, that all these moths can be divided into two groups—(1) those that have no distinct pale longitudinal markings (costal streak, nervures, &c.), but have very complete transverse markings (as in typical *cursoria*); and (2) those that have distinct pale longitudinal markings, with the transverse ones broken up. I have divided my specimens upon this plan, into four distinct sections according to ground colour, *viz.*, grey, slate, brown and black, and these again are distinctly graduated according to the depth of these various ground colours. I place forms with the same ground colour in following rows—(1) with the transverse markings and not the longitudinal; (2) specimens with the same ground colour as the previous row but with longitudinal markings. Nearly five drawers of picked *tritici* arranged in this way make material for careful study and carry conviction with them. I wish now speci-

ally to refer to those forms of *tritici* which are without longitudinal markings. These specimens, whitish-grey, slate-colour, yellowish-ochreous, brown, reddish-brown, intense black, with every intermediate colour, have every line, every mark the same as Hübner's *cursoria* and every one else's *cursoria*, but they are *tritici*, taken in copulation with streaked *tritici*, and occur in equal abundance with these *tritici*, some forms, streaked and unstreaked, being of equal rarity. The great mass of these forms in my possession came from one locality, Deal, but I have a very large number of *tritici* from other localities, thanks to the kindness of my numerous correspondents. Misled by the text-books, I considered all these striking unstreaked specimens as *cursoria*, and, like many others, put them in my cabinet as such. Newman gives Kent as a locality for *cursoria*, but I do not believe anything of this form which we can look upon as at all distinct from *tritici* is obtainable on our Kent coast, and there is no doubt that the endless variation from grey-white to rich red-brown and black, precludes the idea of selecting one special form and saying, "This is *cursoria*," to the exclusion of all others, simply because they are of a different ground colour.

Now with regard to true *cursoria*. A well-developed local form of this "non pale-costa" part of the group is obtainable on many parts of the coast, which seems at first sight sufficiently distinct to call a species; but this form is in itself very inconstant. It is distinct in itself, but has a great number of local races and forms; and since our correspondents send us picked insects which they themselves are able to distinguish as belonging to *cursoria* and not to the allied *tritici*, it is difficult to say how reliable the forms are, or whether, if one obtained an immense series of *tritici* and *cursoria* from the same districts, they would exhibit the same distinctness they certainly appear to do. To return, the Lancashire specimens have generally, in the "non pale-costa" type, a well-developed dark mark in the lower half of the reniform. This seems to be there a most constant character, but I have *tritici* from Deal with this same character well developed, and some undoubted *cursoria* forms are without it. From Sligo, where my kind friend, Mr. Percy Russ, gets *cursoria* perhaps more abundantly than any other collector, I have a long series, but no trace of this special development appears except in two specimens, and then only slightly; neither does there appear to be this development among the *cursoria* from the Welsh coast. On the Scotch coast some marvellous specimens are obtainable, characteristic ochreous *cursoria* leading up to perfectly melanic forms. To me a very strange and important problem presents itself: Why is it that in all these localities none of the magnificent forms—white, slate-colour, black *cursoria*-like forms—of *tritici* are present? I am assured by collectors from these localities, that the great mass of variation of the forms without pale costæ that I get at Deal is not obtainable in their localities; and when Mr. Percy Russ looked over my collection some time ago, with all his experience he said he had never met with such forms, and I think he gave up altogether the attempt to solve the problem which species many of my specimens represented. But now comes another important matter. *Cursoria* is looked upon as an insect without a pale costa, but I have seen some splendid varieties from Sligo, the Lancashire and Cheshire coasts, the Welsh coasts and other

localities, with splendidly developed pale costæ and all the characteristic longitudinal markings of *tritici*, and without, or almost without, any transverse markings. This creates another difficulty, and only the most practised eye can distinguish some of these and correctly refer them to their right species. I will not go so far as to say that in some instances they cannot be named, but, except by the small proportion of our oldest entomologists who have given this matter special attention, I doubt whether they would be distinguished. But although there is so much to increase the difficulty of determination, yet I do not for one moment believe that *cursoria* and *tritici* are specifically identical in the same way as are *tritici* and *aquilina*. My Kent specimens are purely and simply *cursoria*-like varieties of *tritici*, and I do not believe that *cursoria* occurs on that part of the Kent coast from which so many cabinets have been supplied. I look upon these similar varieties, therefore, simply as a development of parallel variation in the allied species, but this parallelism is so complete that it is really marvellous to me how, in the one species, *tritici*, all the characters of all the allied species are developed in special forms, and how these lead up to their respective extreme forms of development, which have at last become distinct, or, as we call them, species.

It has been pointed out to me that *cursoria* is a differently shaped insect to *tritici*. My answer is that in this group, shape is nothing. I have some remarkable forms of *tritici* with the wings almost as broad as they are long, others, with wings long and exceedingly slender. Normal well-developed *tritici* differ but little in shape from well-developed normal *cursoria*; but one factor in favour of considering *cursoria* distinct, is the fact that at Sligo the wings are always well-developed and ample, while it is unusual to find a specimen of any of the various varieties of *tritici*, which is not exceedingly small and undersized. It may be that the *cursoria* are more suited to their environment, but there is no difficulty to distinguish the *cursoria* forms from *tritici* taken on the same ground, while there is great difficulty to distinguish *cursoria* from Sligo and the Lancashire coast, from certain forms of *tritici* captured at Deal.

We have now to consider another species—*obelisca*. Until I obtained Continental specimens and studied Continental authors, I must own I did not know what the species was. I had, as most lepidopterists I suppose have, specimens which had been obtained by exchange, and which my correspondents undoubtedly believed were the species they represented them to be. As those lepidopterists who believe they get the species must supply those that know they do not, there must be, I am afraid, a strange lot of *obelisca* in some cabinets. By some occult method of reasoning on the part of my correspondents, nearly all the *obelisca* I got were black (although the type is reddish-brown), and, with one exception (two specimens which came from Paisley), were *tritici* pure and simple, in a few cases worn until their specific rank was a little dubious, in others exceptionally dark, but undoubtedly *tritici*. With regard to *obelisca*, I feel dubious whether we get any extreme forms of the redder or paler type. The Isle of Wight specimens have been taken rather freely of late years by Mr. A. J. Hodges. The only other localities in which they appear regularly to occur, are in Scotland. Generally these latter are dark, darker than those from the Isle of Wight, which still come undoubtedly near to var. *hastifera*, Donz. It does not

seem to be generally known how exceedingly pale the Continental specimens of *obelisca* are in their palest forms, leading up to the var. *hastifera*, Donz. of mountainous districts, which is of a distinctly vinous-black coloration. It is because this insect is, compared with its congeners, rare in Britain, that one is unable to express the same certainty with regard to it. My own series numbers less than thirty undoubted British specimens, a number altogether inadequate to give any idea of its extent of variation. The Continental forms help one, however, to get a better idea of its affinities. Mr. Percy Russ has captured in Sligo some fine forms of *cursoria* bearing a great superficial resemblance to var. *villiersii*, Hb., but undoubtedly distinct from that variety and to be referred to *cursoria*, thus giving another instance of parallel variation in these allied species. The specimens which we obtain from the South of Scotland are indistinguishable from specimens of var. *hastifera* which I have from various German localities, but some of these are very close to dark vars. of *tritici*, although a well-trained eye readily distinguishes between them. There is another variety, var. *ruris*, about which there is a great deal of difficulty in my mind. Some specimens of this variety, which came through a well-known lepidopterist (Mr. Dobrée) into my hands, from Dr. Staudinger, are altogether unlike all my previous thought of what *obelisca* ought to be, and altogether unlike the type of *ruris*, Hb., fig. 416, which is a streaked form. They appear to be identical, however, with Guenée's *ruris*. They are like some of my specimens of *tritici* which I called *cursoria*-like, *i.e.*, they are without the pale costa, without the pale longitudinal markings; in fact, they bring us back to the root of the matter again, *viz.*, that *tritici* and *obelisca* have *cursoria*-like forms, whilst *cursoria* has the streaked *tritici*-like forms, and that these varieties run in their extreme forms into each other so much, that it is only by training the eye specially, that any real difference is to be detected between any one of the species and the allied ones, for the members of the whole group are so closely interwoven one with the other, that it is most difficult to tell where one ends and the other begins.

I firmly believe, and consider it impossible of contradiction which can be proved, that *aquilina* is a pretty generally distributed variety of *tritici* which has never become localized, and which freely interbreeds with typical *tritici*, and is therefore altogether, on any ground whatever, unentitled to rank as a species. I also consider that *cursoria* is an extreme development of *tritici*, which has become specially modified and constant within certain limits, that the specimens breed *inter se*, and form a distinct species. It appears to be what Dr. Staudinger would call a Darwinian species. I look upon *obelisca*, however, as a still more highly specialised form, and consider that its constancy in Britain may be either a proof of its more complete development, or, owing to its greater rarity, a proof of our ignorance in not knowing the different forms of variation through which it may extend.

Agrotis, Och., *obelisca*, Hb.

The type of this species is Hübner's fig. 123, which may be described as follows:—"Anterior wings of a deep dull red coloration, with ochreous costa, dark hind margin and typical stigmata. The

hind wings are white, clouded with dull reddish on the margin" ('Sammlung europäischer Schmet.'). Our British specimens are very unlike the Continental type, and belong to Donzel's *hastifera*, which Dr. Staudinger in his 'Catalog,' p. 88, treats as a species distinct from *obelisca*. It is strange that our British specimens from Perth and Ayton (Berwick) agree almost exactly with the ordinary form of the specimens captured in the Isle of Wight, so far as the general characters are concerned, although the latter are greyer in colour, and that the paler reddish type is, so far as I know, never obtained in Britain. Of the general variation of the species, Guenée says:—"It requires a trained eye to distinguish this from certain varieties of neighbouring species and still more so to distinguish its own varieties. Some characters however, may serve to guide the inexperienced.—The superior wings are always of some shade approaching violet; the costa is always clear; the stigmata frequently blend with this pale colour in their upper parts. There are only the slightest traces of cuneiform marks before the terminal space, which is of an uniform grey. Inferior wings very much more bluish than ochreous, with the fringe concolorous and with a light terminal shade in the males. Anus tinted with reddish" ('Noctuelles,' vol. v., p. 291). Of these characters, it is doubtful whether many of our specimens approach a violet shade. I have a specimen which came from Dr. Staudinger as var. *ruris*, which has not got a clear costa. Guenée also fixes the normal French type as intermediate between the *pratimcola* and *obelisca* of Hübner. There are a number of described and figured continental varieties, but I look upon all our British varieties as sub-vars. of *hastifera*, Donz.

The following appear to be the best-known forms:—

- 1.—Deep dull reddish-brown, with ochreous costa = *obelisca*, Hb.
- 2.—Reddish-brown, with greyish costa = *ruris*, Hb.
- 3.—Reddish-grey, with no costal streak = *ruris*, Gn.
- 4.—Deep violet-brown, with white costa = *plectoides*, Gn.
- 5.—Pale purplish-grey, with yellow costa = *villiersii*, Hb.-Gey.
- 6.—Greyish-ash, with an ochreous tinge, and almost unicolorous costa = *villiersii*, Gn.
- 7.—Blackish-vinous, with costa whitish = *hastifera*, Donz.

a. var. ruris, Hb.—Hübner's figure 416 may be described as follows:—"♀. Anterior wings of a dull reddish-brown colour with a slight purplish tinge, a short black streak near the base of the median nervure, with a broad greyish-ochreous costal streak; two transverse basal lines, white in costal area, pale ochreous towards the inner margin; claviform large, dark brown, outlined in black, orbicular outlined in white; reniform ochreous, also outlined in white—a dark red quadrate spot between the stigmata; a double dusky wavy line beyond reniform, another from apex to anal angle cuts off darker hind margin. Hind wings dark grey with whitish base and distinct lunule." Staudinger ('Catalog,' p. 87) treats Hübner's *ruris* as synonymous with the *ruris* of Guenée, and writes:—"al. ant. fere unicoloribus," but this is an error and applies only to Guenée's *ruris*, certainly not to Hübner's, as may be seen from the description above.

β. var. ruris, Gn.—Guenée thus described this variety:—"Larger. The superior wings of a clear reddish-grey, the costa concolorous with

the rest of the wing, the ash-coloured stigmata larger, the claviform almost absent. The inferior wings whiter, tinged with blackish on the outer edge in the ♀ " ('Noctuelles,' vol. v., p. 292). Guenée also adds:—"It is rare and forms a link between the type and the variety *villiersii*, but has not the same outline of wing as the latter." It will be seen that this differs from Hübner's *ruris* in having no pale costa.

γ. var. *plectoides*, Gn.—This variety is described by Guenée as follows:—"Shape of the type. The superior wings more pointed at the apex, of a shiny violet-brown colour resembling *Noctua plecta*, uniform, without any transverse line and with only slight pale traces of the subterminal. The costa and stigmata of a pale testaceous, the orbicular slightly angled; the reniform lengthened out, the whole placed in an elongated isosceles triangle, deep black in colour. Claviform absorbed in the ground colour. Inferior wings very dark." He then adds:—"This variety has a particular facies, and I should not hesitate to make it a distinct species, if I did not know what astonishing variations *obelisca* presents. However, it is necessary to see many more specimens" ('Noctuelles,' vol. v., p. 292). The ♀ specimen described, came from Lapland.

δ. var. *villiersii*, Hb.-Gey.—Geyer's fig. 869, is a male. "The anterior wings pale purplish-grey with primrose-yellow costa; a short, dark costal streak, whilst another before the orbicular is the commencement of an incomplete, double, transverse basal streak; the claviform is represented by a broad black lunule; the orbicular and reniform are yellowish, surrounded with black; a wavy line directly beyond reniform, another near hind margin; nervures distinct on outer margin. Hind wings grey, with a pinkish tinge, nervures distinct" ('Sammlung europäischer Schmet.,' fig. 869). Fig. 870 is a female, with the markings as in 869, but the ground colour deep purplish with a slight but distinct reddish tinge. Staudinger again ('Catalog,' p. 88) incorrectly refers Guenée's as well as Geyer's *villiersii* to the same variety.

ε. var. *villiersii*, Gn.—Guenée's original description of this variety is:—"Agrotis. ♂. Alis anticis, ochraceo-cinereis, maculis duabus costaque albicantibus, posticis albis; antennis pectinatis; apice filiformibus.—♀. Alis anticis cinereo fuscis; posticis ad marginem late infuscatis; antennis filiformibus" ('Ann. Soc. France,' 1837, p. 173). This is of course a costal-streaked form and differs considerably from his description in the 'Noctuelles,' where he writes:—"Always larger than the type, the superior wings proportionally more oblong and squared, powdered with clear greyish-ochreous ash colour; the terminal space slightly darker, the costa and the stigmata less marked, compared with the clearness of the ground colour; the stigmata outlined finely with black; the claviform more oblong. The underside of the superior wings with a blackish cellular spot. Antennæ long, strongly ciliated for almost half their length, then roughened to their tips. Thorax almost unicolorous and pale." This variety was described from specimens taken in central France. Guenée also adds:—"I have seen a subvariety in which the superior wings are unicolorous and almost without stigmata" ('Noctuelles,' vol. v., p. 292).

ξ. var. *hastifera*, Donz.—Donzel's *hastifera* is, very wisely I think, kept distinct from *obelisca* by Dr. Staudinger in his 'Catalog,' p. 88. The other forms of *obelisca* are so decidedly distinct in appearance, that there appears to be every reason for doing so, at any rate provisionally. Donzel's diagnosis is as follows:—"♂. Alis anticis brunneis, vittâ costali, albâ, latâ; maculis duabus ordinariis albidis. Posticis albis. Antennis valdè pectinatis, apice undis. ♀. Alis anticis rufo-cinereis; vittâ, costali albidâ latâ; maculis duabus ordinariis albidis. Antennis filiformibus" ('Trans. Ent. Soc. France,' 1847, p. 525). The types are also figured in the same work. Plate viii., fig. 1 is a ♂ of a distinct vinous or purplish-brown tint, shaded a little with bluey or slate colour, yellowish costal streak and stigmata; blackish between orbicular and reniform. Fig. 2 is a ♀, reddish-brown in colour—very much more variegated than the ♂, the wedge-shaped spots, elbowed line (made of dots) &c. all very distinct. Of this form Guenée writes:—"Of a vinous-black, with the white costa very distinctly separated from the rest of the wing, the orbicular grey, and the reniform generally tinted with yellow superiorly." "Habitat generally in mountainous countries" ('Noctuelles,' vol. v., p. 291). Here then we have another dark Continental, melanic, mountain form, becoming practically the type in Britain, another example of humid conditions accompanying melanism. I find a great deal of minor variation in our British specimens, those from Ayton (Berwick) and Perth being as dark as specimens that I have from Hungary, but with the transverse lines better developed, often with traces of the development of the wedge-shaped spots, parallel to the outer margin, so characteristic of the allied species, but so rarely developed in this. The Isle of Wight specimens are paler, and although only a sub-var. of this, are worthy of a distinctive name.

η. var. *grisea*, mihi.—The specimens from Freshwater (Isle of Wight) are rarely as dark as the Scotch specimens, but generally finely dusted with grey scales, giving the ground colour of these specimens a somewhat paler appearance. The form is, however, very closely allied to *hastifera* and varies in the same way, sometimes having well-developed transverse lines and occasionally traces of the row of cuneiform spots, which are so rarely found in the paler and more typical forms of this species. The greyer ground colour shades off imperceptibly into the still paler costa, the latter therefore does not stand out so markedly conspicuously as in the very dark forms of the previous variety. I have seen specimens where the vinous tint gives this variety a reddish appearance and it then somewhat approaches the type coloration and that of Guenée's *ruris*, but this variety, like *hastifera*, is smaller than those forms.

θ. var. *pratincta*, Bork.—Closely allied to Hübner's type is Borkhausen's *pratincta*. This may be described as being "of a dull brown colour with a white costal margin; the two stigmata, one round and one reniform in shape, are whitish with a light-brown centre. Under the orbicular stands a brown longitudinal mark, which is attached to the transverse basal line; beyond the reniform is a transverse row of brown pointed marks. Hind wings white with a darker hind margin and blackish band" ('Naturegeschichte' &c., p. 553, No. 225). Guenée refers this to his *obelisca*.

Agrotis, Och., *nigricans*, Linn.

This is another variable species, and the different varieties have been described by several authors as different species. Owing, however, to the dull appearance of the species, and the want of decided characters in the markings, the varieties which have been named are most difficult to classify. The type is blackish-fuscous, with the transverse lines somewhat paler than the ground colour. The Linnæan description is:—" *Ph. Noctua nigricans spirilinguis cristata, alis nigricantibus maculis ordinariis pallidioribus.*" "*Rustica media. Alæ superiores fusco-nigricantes magis quam in alia ulla nostratum, uti etiam totum corpus. Inferiores alæ parum albescentes*" ('Fauna Suecicæ,' p. 322, No. 1220). Generally our species are black, blackish-grey, reddish-brown or red, but pale greyish varieties occasionally occur, although they do not appear to be noticed by Continental authors. The transverse lines and stigmata are sometimes darker than the ground colour, at other times obsolete, sometimes paler, and occasionally bright yellowish in colour. Very rarely, a row of white dots is found parallel to the hind margin, modified occasionally into a white line. The name *fumosa* has been applied by different authors to different varieties, Fabricius and Treitschke only, agreeing in their definition as to what the form is. There is (as is usual in this genus), some variation in the shape and position of the stigmata, and there is also considerable variation in the colour of the hind wings, those of the females being darker than those of the males. Among the red varieties, we find specimens not only with the transverse lines and stigmata yellow, but with the nervures dusted (sometimes throughout their whole length) with yellow scales.

This is a species treated at length by Bentley ('Entomologist,' vol. i.), who was the first British author to connect the various forms as one species. He writes as follows:—" *Agrotis nigricans, fumosa, ruris, dubia, obeliscata.* These varieties are found in most of our counties; and I have selected this genus because I know many of your correspondents have taken them, and can therefore examine and judge for themselves. I have taken them in woods, marshes and gardens; and we have taken several varieties in our little garden in Critchell Place, from the flowers of the sunflower (*Helianthus annuus*). *Var. 1.* Anterior wings dark fuscous or blackish, with an obscure black line from the base, united to the teliform stigma, and a transverse waved line from before the anterior stigma; posterior wings ashy with dusky margins. *Var. 2, nigricans.*—Anterior wings dusky, with three transverse, dark, waved strigæ and three stigmata, all margined with black; posterior wings ashy with dusky margins. *Var. 3.*—All the wings dark fuscous, with the three stigmata margined with deep black. *Var. 4, fumosa.*—All the wings blackish, with the posterior stigma tinged with yellow, the teliform stigma entirely wanting. *Var. 5.*—Anterior wings fuscous, with a conspicuous waved line before the anterior stigma, and a quadrate black spot between the stigmata, posterior wings white, margins black. *Var. 6.*—Anterior wings fuscous, with two transverse, yellow, waved strigæ; posterior stigma yellow. *Var. 7, dubia.*—The beautiful specimen before me is a female; with four transverse yellow strigæ, the first near the base and interrupted, the second before the anterior stigma, the third behind the posterior, and the fourth parallel with the posterior margin,

which is spotted with black; posterior wings dusky. I obtained this variety from the cabinet of Mr. Stone. *Var. 8.*—Light brown, the markings very obsolete, except a few yellow dots upon the costa. *Var. 9, ruris.*—Anterior wings light brown or reddish, with various yellow spots and streaks, the ordinary stigmata tinged with yellow. *Var. 10.*—Red-brown, with two transverse strigæ and a row of dots near the posterior margin, yellow; posterior wings white, with a well defined fimbria, margin fuscous. *Var. 11.*—All the wings red-brown, with the stigmata a little paler. *Var. 12, obeliscata.*—Anterior wings red-brown, with a long black spot interrupted by the anterior stigma and based upon the posterior. I obtained this variety from the cabinet of the late Mr. Haworth as his type of *obeliscata*. The above connecting links are described from specimens in my collection. The vast number of specimens I have examined, sent to me from different parts of the country for that purpose, varying from a dingy black to a light red, with all the intermediate grades of character and tints of colour, have convinced me that they all constitute but one inconstant species." It will be seen that Bentley's application of the varietal names is not always strictly correct, but he seems to have had, for his time, a remarkable knowledge of the range of variation in this particular species. It is frequently difficult to locate various varieties, and different authors repeatedly use the same name for entirely different varieties. It may be here remarked, that the palest forms of *nigricans* are generally obtained in the more southern localities in Britain, but, that in Lancashire and in various Scotch localities, the fuscous and black varieties are almost the only forms to be met with.

The following table illustrates the range of variation in the species:—

A.—Ground colour grey.

- 1.—Grey with reddish tinge, stigmata and strigæ almost obsolete = *pallida*.
- 2.—Grey with reddish tinge, stigmata and strigæ yellow = *flavo-pallida*.

B.—Ground colour pale reddish.

- 1.—Red, with stigmata and strigæ of a paler shade of ground colour = *rufa*.
- 2.—Red, with stigmata and strigæ yellow = *ruris*, Haw.
- 3.—Red, with a dark patch between the stigmata = *obeliscata*, Haw.
- 4.—Red, with the stigmata, transverse strigæ and longitudinal dashes along nervures bright ochreous = *striata*.
- 5.—Red, with characters of 3 and 4 combined = *rufo-variegata*.

C.—Ground colour dark reddish-brown.

- 1.—Reddish-fuscous, with stigmata and strigæ of a paler shade of ground colour = *rubricans*, Esp.
- 2.—Reddish-brown, with transverse strigæ and stigmata yellow = *vilis*, Hb.
- 3.—Reddish-fuscous, with dark quadrate spot between orbicular and reniform = *quadrata*.
- 4.—Reddish-fuscous, with transverse strigæ nearly obsolete, but stigmata and transverse shades along nervures ochreous = *ochrea*.

5.—Reddish-fuscos, with characters of 3 and 4 combined = *fuscovariegata*.

D.—Ground colour blackish-brown or blackish-fuscos.

- 1.—Blackish-fuscos, with darker stigmata and strigæ, white line at outer margin = *dubia*, Haw.
- 2.—Blackish-fuscos, with stigmata paler = *nigricans*, Linn.
- 3.—Smoky-brown, paler strigæ and ochreous reniform = *fumosa*, Godart.
- 4.—Sooty-brown, with yellow strigæ, and indistinct stigmata = var. *marshallana*, Westwd.
- 5.—Blackish-brown, with darker transverse lines and stigmata, border of reniform white (almost unicolorous) = *ursina*, Godart.

E.—Ground colour black.

- 1.—Black, 3 stigmata yellowish, transverse lines yellowish = *carbonea*, Hb.
- 2.—Black, 2 stigmata yellowish, transverse lines pale grey = *fumosa*, Haw.
- 3.—Black, with paler strigæ and a row of white spots = *fumosa*, Fab.
- 4.—Smoky-black, unicolorous, except outline of stigmata rather paler = *fuliginea*, Godart.

A.—Ground colour grey.

a. var. pallida, mihi.—This is a most unusual variety and but rarely captured. It has the ground colour of the anterior wings of a pale grey, with the faintest possible trace of a reddish tint, the stigmata and transverse lines being only indicated, as they are of almost the same shade as the ground colour. I have but very few specimens, and have only seen them from the Greenwich marshes and from Deal.

β. var. flavo-pallida, mihi.—This is like the previous variety so far as the pale ground colour is concerned, but instead of the stigmata being of almost the same greyish tint as the ground colour, they are yellowish and much more distinct. It is, however, also a rare variety, and, so far as I at present know, confined to our Southern counties, as I have specimens from different localities in Kent only.

B.—Ground colour pale reddish.

a. var. rufa, mihi.—Anterior wings of a pale reddish tint, with the basal, elbowed and subterminal lines of a somewhat paler shade than the ground colour; the orbicular tending to merge in the ground colour, the claviform indistinct, slightly ochreous outlined with darker, the reniform more or less ochreous. The hind wings grey with the base paler. This is altogether a more obsolete and less distinctly marked variety than *ruris*, which has well-developed yellow stigmata and strigæ. My specimens came from Greenwich and Deal.

β. var. ruris, Haw.—Haworth's diagnosis of this variety is as follows:—" *Noctua*. Alis sordide rufis stigmatibus tribus strigisque flavicantibus " (' *Lepidoptera Britannica*, ' p. 221). This is a fairly common variety in Kent, but I believe it is comparatively rare in the North of England and in Scotland, where the darker varieties preponderate, although I have one specimen from Aberdeen, and another from Hartlepool. It runs, by intermediate forms, into all the other varieties having the same ground colour. I have also taken this form in the Isle of Wight.

γ. var. *obeliscata*, Haw.—Haworth's diagnosis of this variety is as follows:—"Noctua. Alis rufis macula atra trigona ante, alteraque tetragona inter stigmata pallida." "Statura exacte penultimæ at fere absque strigis. Stigma teliforme nigro cinctum est, et ad basin alæ fere excurrit. Margo posticus undulatum paulo saturatior. Alæ posticæ albido-flavicantes fimbriâ angustiore ciliisque rufescentibus" ('Lepidoptera Britannica, p. 222). This is a pretty form with the space between the reniform and orbicular, and also directly beyond the orbicular, much darker than the general ground tint. There is no doubt that this development led to its being named *obeliscata*, this dark marking being then supposed to be specially characteristic of the allied species, *obelisca*. It is not at all a common form in the localities in Kent where the species occurs, and I have only taken a few specimens each year. The strigæ vary very much, from pale greyish or yellowish to blackish. It is interesting to note that Mr. Bentley ('Entom.,' vol. i.) says:—"Anterior wings red-brown, with a long black spot, interrupted by the anterior stigma and based upon the posterior. I obtained this specimen from the cabinet of the late Mr. Haworth as his type of *obeliscata*." All my specimens of this variety have come from Kent. There is a parallel variety with the same dark patch between the stigmata, but having the ground colour very much darker (var. *quadrata*).

δ. var. *striata*, mihi.—The anterior wings of a reddish colour, with the basal area yellow-ochreous to the basal line; the orbicular almost unicolorous with the ground colour; the claviform distinctly ochreous, outlined with a fine black line; the reniform also distinctly ochreous, especially the outer part; the elbowed line ochreous, the subterminal line consisting of ochreous dots; the space between these last two lines strongly sprinkled with ochreous along the nervures and thus giving the variety a streaked appearance, the striations extending to the outer margin. The posterior wings grey with a darker margin. The variety *vilis*, appears to be somewhat similar to this, but much darker and without the pale longitudinal striations, whilst *marshallana* would appear to be (according to Humphrey and Westwood's figure) closely allied to the latter.

ε. var. *rufo-variegata*, mihi.—A pretty mottled form, with red ground colour and ochreous markings. The anterior wings pale reddish with the basal area much mottled with ochreous; the transverse basal line ochreous, edged externally with black, the three stigmata also ochreous, edged with darker; the elbowed and subterminal lines composed of ochreous dots, the space between these being striated longitudinally with ochreous along the nervures. Posterior wings pale grey with darker margin. My specimens have come from Deal and from Freshwater (I. of W.).

C.—Ground colour dark reddish-brown.

α. var. *rubricans*, Esp.—Esper's diagnosis of this variety is as follows:—"Alis superioribus fusco-rubricantibus, stigmatibus striisque marginis exterioris pallidis oblitteratis" ('Die Schmet. in Abbildungen' &c., p. 395). This is followed by a reference to Borkhausen, iv., 468, No. 186:—"Ph. Noctua rubricans.—Red-brown with yellow markings." The figure, Plate 130, fig. 2, is very bad. Guenée writes of this variety:—"Of a reddish-brown often dusted with yellowish, with the

parts of the subterminal line well marked and the stigmata strongly yellowish" ('Noctuelles', vol. v., p. 286). Staudinger simply says of it "dilutior, rubricans" ('Catalog', p. 87), a remark so comprehensive that it is practically useless, as it includes all the allied varieties. This reddish form would appear to be one of our commonest varieties in Kent, where so many specimens are of a reddish ground colour, with the strigæ differing but little from the surrounding colour in shade, except that they are perhaps a little paler. Almost all my specimens have come from Kent. Guenée's reference to this variety would appear to be an extension of Esper's type description, but the pale markings, such as they are, are sometimes of a yellowish tint but differing much from the strongly marked var. *vilis*.

β. var. vilis, Hb.—This variety has "the anterior wings of a dark reddish-brown, with an abbreviated, followed by a complete yellow transverse basal line; orbicular absent; reniform yellow with a yellowish streak from costa to inner margin running right through it; near the apex are three pale costal streaks, the inner of which is continued down, as a broken dotted line, as far as the reniform; the outer costal streak is the commencement of a row of dots parallel to the hind margin. Hind wings ochreous-grey, no markings, base paler" ('Sammlung europäischer Schmet.' &c., fig. 511). Of this variety Guenée writes:—"I have not seen it in nature, but it appears to belong here. The ground colour is like that of the type, with the lines and stigmata well marked, of a clear yellow; the reniform is crossed by a pale line starting from the costa, which replaces the ordinary median shade" ('Noctuelles', vol. v., p. 287). This is a very fine variety, being exceedingly mottled with yellow. I have frequently obtained somewhat similar varieties in different parts of Kent. My nearest approach to this variety has the elbowed line complete, but it does not pass through the reniform as in Hübner's figure, although the upper part is near to it. This variety is incorrectly referred by Bentley ('Entom.' vol. i.) to var. *dubia*, Haw.

γ. var. quadrata, mihi.—The anterior wings of a dark reddish-brown colour; the transverse lines and stigmata paler, sometimes tinged with ochreous; the space between the orbicular and reniform dark, almost black. This variety, with its dark ground colour and still darker quadrate spots, bears a very distinct superficial resemblance to our Isle of Wight specimens of *A. obelisca*. It is of course a parallel variety to var. *obeliscata*, with darker ground colour. I have specimens from Deal, Hartlepool, Greenwich and Aberdeen.

δ. var. ochrea, mihi.—A dark reddish-brown form, closely allied to var. *striata*. There are distinct yellow, longitudinal dashes under the bases of the median and sub-costal nervures; the transverse basal line is distinctly ochreous; the orbicular and claviform slightly ochreous but indistinct, the outer part of reniform yellowish; the elbowed line almost obsolete; the subterminal line represented by ochreous dots, from which ochreous striations pass to the elbowed line. Hind wings grey, outer margin darker. My specimens came from Deal.

ε. var. fusco-variegata, mihi.—The type of this variety I consider the finest specimen of the species in my collection. The anterior wings dark reddish-brown with a purplish tinge, the incomplete and complete, basal, transverse lines ochreous, with ochreous dashes under

the bases of the median and sub-costal nervures; the claviform and orbicular finely outlined in ochreous, the reniform distinctly ochreous; the elbowed line complete and ochreous in colour; the subterminal line composed of ochreous dots; the space between the orbicular and reniform dark. The posterior wings grey with the outer margin darker. Captured at Deal in 1886.

D.—Ground colour blackish-brown or blackish-fuscous.

a. var. dubia, Haw.—Haworth's diagnosis of this variety is as follows:—"Noctua. Alis fuscis vel nigris, strigis stigmatibusque ordinariis saturatoribus, strigaeque alia postica conspicua undulata alba" ('Lepidoptera Britannica,' p. 222). Haworth then adds:—"Simillima penultimæ (*nigricans*), at vix varietas." This is a rare variety, and I have never seen, to my recollection, a specimen with a really white line parallel to the hind margin. I have seen such very pale, but not white. This and *fumosa*, God. are the forms that come nearest to the type, the last (*nigricans*, Linn.) being practically intermediate between them. It will be noted that Bentley in his descriptions already quoted, refers Haworth's name, *dubia*, to the form which is really the *vilis* of Hübner, with four transverse yellow strigæ. As will be seen from the above, the ordinary strigæ in *dubia* are darker not paler.

β. var. fumosa, God.—This variety is described as follows:—"The superior wings of a shiny smoky-brown with two undulated, transverse, black lines, enclosing, besides the two ordinary stigmata an oblong ring and a faint streak equally black; the reniform is outlined with yellowish-white on its outer edge; the wing is also traversed by a yellowish wavy line. The inferior wings are whitish with a blackish terminal band, darker in the ♀ than the ♂" ('Histoire naturelle,' p. 264). It is also figured, Plate lxx., fig. 3 (♂), fig. 4 (♀). The figures are of a smoky-brown colour, with paler transverse lines and ochreous reniform. This appears to be a very common form both in the South and North of England and in Scotland.

γ. var. marshallana, Westwood.—This variety has the dark ground colour and dark stigmata of var. *dubia*, but differs from it in having the strigæ pale yellowish like so many of the varieties of this species. It was first described, named and figured in Humphrey and Westwood's 'British Moths.' The description is as follows:—"This new species appears to be most nearly allied to the variety of *A. nigricans*, which has been named *dubia*.* The fore wings measure an inch and a half in expanse, and are of a dark sooty-brown colour, slightly varied along the principal veins with a lighter gloss, the extreme base being rather lighter than the rest of the wing, and partaking of the colour of the grey-brown thorax. Close to the base of the wing is a very slender dentate, pale transverse line interrupted behind; then follows, at about one fourth of the length of the wing from the base, another more waved pale line, edged on both sides with black, with the base of the black teliform stigma resting on its penultimate wave. The two ordinary stigmata are present, but very indistinct, margined with black, the outer one succeeded at a short distance, by a slightly-waved transverse row of pale arches (but very much incurved towards the costa), and with a fourth pale streak more irregularly waved and less

* These authors incorrectly refer those specimens belonging to var. *vilis* to var. *dubia*.

distinct than the preceding, near the apical margin of the wing, which is dotted with black; the cilia are paler brown, having a fine darker line running through the middle of them. The costa is also marked with several very slight, oblique, pale lines. The abdomen and hind wings are pale brown, the latter with a central, slightly darkened lunule, and with the margin rather darker. The head is fulvous-brown, and the prothorax has the frontal crest marked by two curved lines of grey, edged with dark brown in front" ('British Moths,' pp. 122-123). From Plate xxiv., fig. 15, it can be seen that this is a variety in which the strigæ are ochreous in colour, but the stigmata dark in colour and indistinct. I have no dark specimens which I can refer to this variety.

δ. var. *ursina*, God.—This variety is thus described:—"It is very much like *fumosa*, but differs principally in the less deep colour of all four wings. The superior wings are of a deep blackish-brown, with two transverse undulated lines and three discoidal stigmata, black, but very little darker than the ground colour. The reniform is clear and white on its outer border. It has a transverse wavy line of cuneiform whitish points towards the outer edge of the wing. The inferior wings are brownish-grey in both sexes with a black marginal line" ('Histoire naturelle' &c., p. 271 and Pl. liii., fig. 3). Godart records it from "Styria and Carniola." Another not very uncommon form, although it is not often that the whitish dots near the outer margin are developed.

ε. var. *rustica*, Ev.—Eversmann's diagnosis of *rustica* is as follows:—"Alæ anticæ thoraci concolores, brunneo-fuscæ, maculis ordinariis parvis obsoletis subconcoloribus,—strigis ordinariis, striga media strigaeque submarginali crenulato—interruptis fusco-nigris;—posticæ sordide albidæ, externe fuscescentes" ('Fauna Volgo-Uralensis' &c., p. 193, No. 12). Eversmann then adds:—"Similis nonnullis varietatibus *A. fumosæ*, sed fere duplo minor, differt præcipue alis proportionè brevioribus et earum strigis crenato—interruptis." This is a small sub-variety of *ursina*, still more obsolete, with the markings indistinct and merging into the ground colour. It is a parallel variety of the fuscous group to the unicolorous var. *fuliginea* in the black group. I have a remarkable ferruginous black specimen which I would refer to this variety. It is practically unicolorous, with only the orbicular and reniform very slightly paler than the rest of the wing, all the other marks being absolutely obsolete. The specimen came from Deal.

D.—Ground colour black.

a. var. *carbonea*, Hb.—This variety may be described as:—"Anterior wings very black, with two yellowish basal streaks, three stigmata yellowish, a pale yellow transverse streak beyond reniform and another wavy streak from apex to anal angle" ('Sammlung europäischer Schmet.' &c., fig 700). Fig. 701 is simply the underside of fig. 700. I find that specimens of *fuliginea*, God. have been placed in the British Museum collection under this name, among the series of *Agrotis tritici*. The var. *carbonea* is rare, compared with the var. *fumosa*, Haw., for very few of the fine intensely dark specimens captured in Aberdeenshire, which I have received from Mr. Reid, have the yellow marks characteristic of the former; they are generally pale

grey, or only outlined in paler (var. *fuliginea*). These very dark forms are rare in our more southern localities in the South of England.

β. var. fumosa, Haw.—Haworth's diagnosis of this variety is as follows:—"Noctua. Alis nigricantibus, nigro pallidoque varie strigatis, stigmatibus duobus ordinariis flavo cinctis" ('Lepidoptera Britannica,' p. 221). *Fumosa* is a name given to almost every variety of *nigricans*, by those who are ignorant of the original descriptions, and it is really a very safe name to use, for, whilst *fumosa*, God. is a fuscous variety, *fumosa*, Haw. and *fumosa*, Fab. are black varieties. Haworth's black variety is well distributed, and a large percentage of our black forms would have to be referred to this varietal name.

γ. var. fumosa, Fab.—The diagnosis of Fabricius is as follows:—"Noctua. Cristata alis deflexis nigricantibus: striga postica punctorum alborum." "Nimis *N. nigricans* affinis. Differt tantum striga postica punctorum cuspidatorum, alborum. Corpus totum nigricans" ('Entomologia systematica' &c., p. 115). The chief characteristic of the *fumosa* of Fabricius is the row of white dots near the outer margin, thus resembling, in some degree, var. *ursina*. The form is most unusual.

δ. var. fuliginea, God.—Of this variety Godart writes:—"This Noctuelle, as its name indicates, has the superior wings entirely of a smoky-black or soot-colour in the male, with the two ordinary stigmata very small and scarcely visible although outlined in paler. Looking carefully, one sees a spot near the orbicular and some traces of a broken smoky-ferruginous band near the outer margin. The lower wings are of a shiny whitish colour, with the lunule and the nervures blackish and the marginal edge shaded with bistre. The wings of the female are less dark than those of the male, and a little reddish; they have also traces of a row of dots which are absent in the male; the stigmata are larger and better marked, and the inferior wings are greyish instead of shiny white" ('Histoire naturelle' &c., p. 90). He also figures this var., Plate 78, fig. 5 (♂), fig. 6 (♀). Of these I wrote:—"Varieties of *A. nigricans* of a sooty colour, with only faint traces of transverse lines, the latter clearer on the outer margin." This most unicolorous of all the dark varieties of *nigricans* is not uncommon in Scotland, although rare in the south of England. I believe, too, that a large percentage of the Lancashire varieties belong to this and to var. *fumosa*, Haw.

Agrotis, Och., *cursoria*, Hufn.

This is a most interesting species but exceedingly difficult to deal with, owing to its being so closely allied to *A. tritici*. The ground colour of this species, however, is nearly always more or less ochreous, and, although occasionally strongly tinged with grey, is but rarely entirely of that colour. It is, however, in certain localities very prone to an increase in depth of coloration, and specimens from Aberdeen are occasionally quite ruddy in colour (I have seen Continental specimens entirely red), while other specimens, again, are much suffused with black scales, but the ochreous colour is generally traceable even in the most suffused specimens. As in *tritici*, there are two distinct types, one, with transverse lines and stigmata only, the other, with these lines and stigmata, but, in addition, with a pale costa. The pale-costa variety is comparatively rare compared with the ordinary

transverse lined form, at any rate in Britain. In both these forms, the lines are sometimes more or less obsolete and the stigmata vary excessively. In some pale specimens, the stigmata are obsolete and lost in the ground colour, in others, the lower part of the reniform is strongly marked with black, while the remainder of this and the other stigmata are obsolete. In some darker specimens, the stigmata stand out strikingly pale (in the original ground colour), while in others, the stigmata are unicolorous with the darker colour. The claviform is generally but poorly developed, but, in some specimens, it is remarkably well developed. The reniform and orbicular vary exceedingly in size and relative positions. It is here, perhaps, advisable to mention the almost entire absence of the small wedge-shaped streaks which are so characteristic of *tritici* and its varieties. There is also a small longitudinal basal streak varying in intensity, and occasionally the extreme outer margin of the wing is particularly dark as in certain varieties of *tritici*. The nervures are sometimes noticeably paler than the rest of the wing but not so frequently, nor so well-marked, as in the allied species. Hufnagel's type is described as:—"Yellowish-grey, with two brown curved dentated, and two undulated transverse lines" ('Berlin Magazin,' p. 496). Of the general variation in this species we read:—"It varies considerably in the colour of the fore wings, from a silvery-grey or pale buff to a deep fulvous, reddish or brownish-red, and considerably irrorated with darker atoms, especially towards the centre of the wing; the costa being marked with several dark small spots, arranged in pairs corresponding with the origin of the strigæ, which are distinct and four in number, one near the base, a second more irregular before the inner stigma, another much curved, and consisting of small arches beyond the outer stigma; these strigæ being pale, and each margined with a dusky line on each side. Near the apex of the wing is a more irregular dark striga, the margin of the wing being marked with a row of dark dots. The hind wings are pale, and margined with a broad dusky edge, succeeded by a slender pale line. On the underside all the wings are of a yellowish-white with black dots in the middle, and a row of submarginal dots" (Humphrey and Westwood's 'British Moths,' p. 123). Guenée ('Noctuelles,' vol. v., p. 285) writes:—"This species varies much, but it is so distinct that one is not easily deceived by it," and yet Guenée treats var. *sagitta*, Hb. as a far-away species. Newman says:—"The colour is pale grey tinged with ochreous or brown, and presenting in different specimens almost every shade of colour from pale ochreous-grey to dark brown" ('British Moths,' p. 329). There are two or three very noteworthy characters in this species, (1) the pale nervures, (2) the comparative absence of the cuneiform spots, (3) the darkening of the lower part the reniform. Of course, these all occur in the allied *tritici*, but, what is exceptional in the latter species becomes the rule in *cursoria*. The first group—A—of my classified list is exactly parallel with a similar group in *tritici*, and it is only a most practised eye that can separate them from *tritici*. I am especially indebted to Messrs. P. Russ and T. Baxter for a splendid series of this species.

The following is the best classified list I can make of the varieties I at present know:—

A.—Ground colour slaty-grey.

a.—Without pale costa = var. *cærulea*.

b.—With pale costa = var. *costa-cærulea*.

B.—Ground colour greyish-white (slightly ochreous).

- a.*—With obsolete markings = var. *armena*, Evers.
- b.*—With distinct transverse markings = var. *mixta*, Fab.
- c.*—With longitudinal markings = var. *pallida*.

C.—Ground colour yellow-ochreous.

- a.*—With obsolete markings = var. *obsoleta*.
- b.*—With distinct transverse markings = *cursoria*, Hufn.
- c.*—With longitudinal markings = var. *ochrea*.

D.—Ground colour brown, with a reddish tint.

- a.*—With obsolete markings = var. *obscura*, Stdgr.
- b.*—With distinct transverse markings = var. *brunnea*.
- c.*—With longitudinal markings = var. *sagitta*, Hübner.

A.—Ground colour slaty-grey.

a. var. *cærulea*. mihi.—The type of this variety has the anterior wings of a pale slaty-grey (almost lilac) colour; the abbreviated and complete basal lines, elbowed line and subterminal line all pale greyish-white edged with fuscous; the orbicular pale grey in colour, the reniform ochreous outlined in whitish, the claviform ochreous outlined with darker. Hind wings grey, distinct lunule, outer margin darker. I have only one specimen of this form, a ♀, given to me by Mr. T. Baxter and captured at St. Anne's-on-Sea (Lancashire).

β. var. *costa-cærulea*, mihi.—The anterior wings with the ground colour pale slaty-grey; the two basal, elbowed and subterminal transverse lines all pale grey edged with darker; a pale ochreous costal shade extending from the base to the reniform; the claviform dark brown, the orbicular and reniform outlined in whitish; median nervure grey; a dark brown quadrate spot between the stigmata and a brown shade under median nervure from base to elbowed line. The upper part of transverse lines represented by pairs of short, dark costal streaks. Posterior wings grey, distinct lunule, margin darker. I have only one specimen, from Aberdeen.

B.—Ground colour pale greyish-white (slightly ochreous).

a. var. *armena*, Evers.—This is a pale greyish-white form, without a pale costa, and with all the transverse markings more or less obsolete, so far as can be judged from the specimens in the British Museum collection. The pale whitish-grey form with obsolete markings, I have in my collection, came from Sligo, Aberdeen and St. Anne's-on-Sea. A sub-var. *puncta* occurs,—unicolorous, with the exception of the lower part of the reniform which is developed as a dark dot. This variety (*armena*) differs from the *mixta* of Fabricius in having more obsolete markings.

β. var. *mixta*, Fab.—This pallid form is not uncommon in Britain, occurring generally in all localities with the most yellow type. Fabricius' description is:—"Noctua lævis alis deflexis pallidis fusco subfasciatis: posticis basi pallidis apice fuscis." "Corpus medium, album, immaculatum. Alæ anticæ pallidæ, fusco subfasciatæ, posticæ basi pallidæ, apice fusæ. Subtus omnes pallide" ('Entom. systematica emendata et aucta' &c., p. 36, No. 91). This pale form with distinct transverse markings is more common than either of its near congeners—vars. *armena* and *pallida*. I have it from Sligo, St. Anne's-on-Sea, Hunstanton and Liverpool.

γ. var. *pallida*, mihi.—The anterior wings of a pale greyish-white with an ochreous tint; the costa, reniform and orbicular whitish, the claviform and the space between the orbicular and reniform slightly darker. The upper parts of the transverse lines represented by pairs of short costal streaks, the lower parts of the transverse lines edged with fuscous. My specimens have come from Sligo and St. Anne's-on-Sea.

δ. var. *distincta*, mihi.—I have a fine development of var. *pallida*, in which the pale ground colour of the anterior wings is as in that variety but the space between the orbicular and reniform, a wedge-shaped spot beyond the orbicular, another spot outside the reniform, the claviform and a longitudinal marking under the base of the median nervure are deep blackish-brown. The specimen came from Aberdeen.

C.—Ground colour yellow-ochreous.

By far the greater number of our English and Irish varieties belong to this group, and some of our obsolete forms are remarkably striking.

α. var. *obsoleta*, mihi.—Anterior wings yellow-ochreous in colour, with neither transverse lines nor longitudinal markings developed; the claviform obsolete; the orbicular and reniform perceptible by being slightly paler than the ground colour. Hind wings pale with the outer margin darker. A sub-var., *obsoleta-puncta*, with the lower part of the reniform represented by a black spot, is perhaps rather more common than the absolutely obsolete form. I have specimens from St. Anne's-on-Sea and Tenby, but none of my numerous Sligo specimens exhibit this phase of variation, although the other forms of the yellow-ochreous group are the most prevalent there.

β. var. *ochrea*, mihi.—This is probably the most abundant striated form occurring in England and Ireland, although var. *sagitta* is much more abundant in Scotland where there is a tendency for the ground colour of the varieties to run darker. The anterior wings of this variety are yellow-ochreous with the costa and median nervure paler (but still ochreous in tint), the reniform and orbicular paler ochreous, with a tendency for the lower part of the reniform to be filled in with darker; the space between the orbicular and reniform slightly darker; the claviform outlined in dark; the transverse lines represented by short, paired, black streaks on the costa, with the lower parts very ill-developed. Hind wings pale-grey, outer margin darker. My specimens have come from St. Anne's-on-Sea, Tenby, Sligo, King's Lynn, Liverpool, and a single specimen from Aberdeen, where the paler forms appear to be very rare. I have a fine form with the ground-colour as in this variety but all the paler parts of the wing (costa, median nervure, orbicular, reniform, inner margin and shade from apex to anal angle) of a pale greyish colour. This was given me by Mr. T. Baxter and was taken at St. Anne's-on-Sea.

D.—Ground colour brown, with reddish tint.

α. var. *obscura*, Stdgr.—Staudinger, in his 'Catalog,' p. 86, writes of this variety:—"Alis anterioribus fere totis rufo-brunneis." We rarely in Britain get unicolorous reddish-brown varieties, but in the British Museum collection are two specimens from the Zeller collection, with "the ground colour of the anterior wings a deep and bright red

with pale nervures, a pale outline to the stigmata and a pale dotted subterminal line." These are named *obscura*, Stdgr. I have never seen any British specimens in any way resembling them. Our specimens are distinctly brown, more often ochreous than bright red. I have some Aberdeen specimens particularly red, but not bright, like the specimens just referred to.

β. var. brunnea, mihi.—The anterior wings of a deep suffused reddish-brown, with the two basal, elbowed and subterminal lines, ochreous, outlined with fuscous; these transverse lines originate as paired black costal spots; the nervures are dusted with paler; the orbicular and reniform also outlined in paler (greyish-ochreous), the claviform indistinct. Hind wings grey with a darker margin. My specimens have come principally from Aberdeen, but I have others from St. Anne's-on-Sea and Sligo.

γ. var. marginata, mihi.—I have a striking sub-var of *brunnea* with the whole of the wing as far as the subterminal line of a deep blackish-fuscous; with the two basal lines, orbicular, reniform, elbowed and subterminal lines a little paler; the outer area beyond the subterminal, ochreous. This is a striking form which I received from Aberdeen.

δ. var. sagitta, Hb.—"The anterior wings bright ochreous-brown with a reddish tinge; the distinct, white median nervure giving off two lower white branches beyond the discoidal cell; the apical nervure and the one parallel to the inner margin also pure white; an abbreviated, pale, transverse, basal line supports the pale claviform; while under the base of the median nervure is a short, black, longitudinal streak; the costal area pale; the stigmata outlined in pale; the extreme outer margin dark, broken up by the pale nervures; above the median nervure is a large, dark-brown, wedge-shaped mark, in which is placed the paler reniform and the orbicular extending from before the reniform to the transverse basal line; the central area (under median nervure) dark brown; inner margin pale, like the costa. Posterior wings white, with grey outer margin and distinct lunule" ('Sammlung europäischer Schmet.', fig. 596, ♂). This beautiful variety, so long considered by our Continental lepidopterists as a distinct species, is one of the more common forms of the species in the northern parts of Britain. I have some magnificent specimens from Aberdeen and Shetland and it occasionally occurs at Sligo and St. Anne's-on-Sea, although var. *ochrea* is the common striated form in these localities. Guenée treated it as a distinct species and placed it between *A. vallisera* and *A. puta*.

Agrotis, Och., *tritici*, L.

If there is any British species more variable than all others, this is probably the species. I felt some difficulty about the way I should deal with *Apamea oclea* but I must own I feel considerably more difficulty with this species. In this, great as are the differences between the different forms, it is entirely in different shades of ground colour, and suppression or special development of markings, that the variation takes place. The ground colour is most extreme, varying from almost pure white to almost pure black. In this species there are two distinct types in the character of the markings:—1. With four transverse strigæ, two before and two beyond the three stigmata, which are generally well marked. 2. Also with four transverse strigæ

and three distinct stigmata, but, in addition, with a pale costa and nervures. This latter character (pale longitudinal markings) gives a very decided appearance, and the extreme varieties of "the pale-costa group" and "the non-pale-costa group" appear so distinct, that it seems almost incredible to believe that they are of the same species. In each of the two above-mentioned groups, there is a great deal of difference in the intensity of the markings. Some specimens are without the transverse strigæ, and others have the stigmata very indistinct. I have some specimens, so devoid of distinct markings, that they may be looked upon as practically obsolete; the stigmata, however, are less liable to suppression than the transverse strigæ, in both forms. Besides the above markings, there exists, normally, a series (variable in number) of small wedge-shaped spots, situated on the third transverse striga (counting from the base) and pointing towards the base of the wing. These also are sometimes entirely suppressed, but sometimes abnormally developed, thus giving a peculiar lineolated appearance to the outer area of the wing. The reniform is extremely variable in shape, size, and intensity of colour; as also are the reniform and claviform stigmata, but this is common to almost all the *Agrotidæ*. Returning now to the ground colour, the variation deserves more than a passing notice. Two shades I have never seen in any specimens except among those taken at Deal. These are the whitish-grey and the slate or dove-coloured forms, although lilac-coloured *obelisca* (probably *tritici*) were referred to (*ante* p. 22). The palest of the white, and the most strongly dove-coloured forms are magnificent specimens, and some of our leading lepidopterists, both British and Continental, had never seen these beautiful forms until I sent examples to them. The dove-colour, combined with reddish-brown, makes a purplish-red form which is very interesting, but which is fairly widely distributed, on the Continent. There are also specimens better described as purplish-grey than either of the other ground colours. The fuscous or greyish-fuscous specimens are probably the most common in Britain and these are often more or less cinereous in appearance. These forms are also common on the Continent. The ochreous-brown and red-brown groups comprise the *aquilina* group, which, in Britain, has died a hard death as a distinct species. Brown or red-brown is the prevailing colour of the Irish specimens, while black or brownish-black appears to be the prevailing colour in Scotland. With regard to the hind wings, there is a considerable amount of variation. I have males with the hind wings almost pure white, but the normal colour is pale grey, with a darker hind margin, those of the females being much darker than those of the males. Many of the varieties have been described by Haworth, Hübner and Stephens as distinct species. With regard to the naming of these different forms as distinct species by our early authors, Mr. Bentley, who, half-a-century ago, was one of the best authorities on the variable species of our British *Noctuæ* writes very sensibly in the 'Entomologist,' vol. i., p. 265, where he says:—"It must be acknowledged that when the varieties in this genus were first named by the author of 'Lepidoptera Britannica,' many of them were comparatively rare, and in some cases only unique specimens were known. With such limited information it is not in the least surprising that they should have been considered distinct species. The case is now

different; lepidoptera has become the favourite order, and we have scientific observers and collectors in almost every county; and by newly-devised means, vast numbers of lepidopterous insects are annually captured, thus affording facilities for determining species and varieties." What was true half-a-century or more ago, tells with tenfold force now, when lepidopterists are not only in "almost every county," but almost every large town, and when the London lepidopterists alone, probably outnumber all the collective British lepidopterists of that date. I will not now enter into a discussion as to why I consider this species distinct from *aquilina*, but I am quite in agreement with Continental lepidopterists in this matter; so also I am now with regard to the utter distinctness of *cursoria* and *obelisca*. Guenée writes of this species:—"This species is very difficult to distinguish from *aquilina*, both by the figures and descriptions, and so many authors have confounded them, that it is almost impossible to correctly establish the synonymy of the varieties. However, a practised eye is not easily deceived. The following appear to me the chief distinctive characters:—The anterior wings are narrower and less mottled, they are more generally grey than brown, the reniform spot is smaller, the inferior wings less white, with the outer margin more speckled with black, the cilia on the antennæ of the ♂ are finer" ('Noctuelles,' vol. v., p. 288). He describes four varieties—**A, B, C** and **D**—and says that he is "unable to refer the species of the English authors to these varieties. I fear, moreover, that some have been mixed with *aquilina*" ('Noctuelles,' vol. v., p. 289). Guenée refers Hübner's *unicolor*, fig. 544, to *aquilina*, but I am inclined to agree with Treitschke ('Die Schmet. von Europa,' vol. i., p. 163) who refers it to *exclamationis*. I believe Guenée's *gypsetina* ('Noctuelles,' p. 290) is a var. of *tritici*. Hübner's *tritici* ('Sammlung europäischer Schmet.,' fig. 151) appears to be another species (*crassa*). Guenée calls figure 151:—"Crassa, var. A. = *tritici*, Hb." Humphrey and Westwood ('British Moths,' vol. ii., p. 119) write:—"We have here one of the most difficult, because most inconstant, of all the *Noctuidæ*, no two specimens being exactly alike, whence so many of the varieties have been regarded as distinct species;" but these authors themselves treat many varieties as distinct species. The description of the Linnæan type has been previously given on p. 23.

A.—Ground colour pale slaty-grey.

- | | |
|-------------------------|--|
| a. Without pale costa. | { 1.—Transverse and longitudinal markings obsolete = var. <i>obsoleta</i> .
2.—As in 1, but lower half of reniform blackish = sub-var. <i>puncta-obsoleta</i> . |
| b. With pale costa. ... | { 1.—Transverse markings indistinct; longitudinal, slightly developed = var. <i>costa-obsoleta</i> .
2.—As in 1, but very small = sub-var. <i>nana</i> , Zell. |

B.—Ground colour clear slate or dove-colour.

- | | |
|-------------------------|---|
| a. Without pale costa.— | Transverse markings more or less distinct = var. <i>cærulea</i> . |
| b. With pale costa. | { 1.—Transverse and longitudinal markings more or less distinct = var. <i>costa-cærulea</i> .
2.—As in 1, but very small = sub-var. <i>minor-cærulea</i> . |

C.—Ground colour slaty-fuscous.

- a. Without pale costa.—Transverse markings more or less distinct = var. *eruta*, Hb.
 b. With pale costa.—Transverse markings more or less distinct = var. *vitta*, Hb. (?).

D.—Ground colour greyish-white.

- a. Without pale costa.—Transverse markings more or less distinct = var. *pallida*.
 b. With pale costa. { 1.—With distinct markings and dark space between stigmata = var. *sagittifera*, St.
 2.—With indistinct markings = sub-var. *obsoleta-pallida*.

E.—Ground colour pale greyish-fuscous.

- a. Without pale costa. { 1.—Markings distinct = var. *fusca*.
 2.—Markings indistinct = sub-var. *siliginis*, Gn.
 b. With pale costa.... { 1.—With distinct transverse markings = var. *costa-fusca*.
 2.—With dark space between stigmata and no cuneiform spots = sub-var. *subgothica*, Haw.

F.—Ground colour dark greyish-fuscous.

- a. Without pale costa. { 1.—With distinct transverse markings = var. *sordida*, Haw.
 2.—With two transverse lines, central area pale = var. *pupillatus*, Haw.
 b. With pale costa.—With distinct markings = *tritici*, L. (the type).

G.—Ground colour pale yellowish-ochreous.

- a. Without pale costa.—Transverse markings more or less distinct = var. *ochracea*.
 b. With pale costa.—With more or less distinct markings = var. *detorta*, Ev.

H.—Ground colour reddish-brown.

- a. Without pale costa. { 1.—With distinct transverse markings = var. *valligera*, Haw.
 2.—With indistinct transverse markings = var. *cuneigera*, St.
 b. With pale costa.... { 1.—With distinct transverse markings = var. *albilinea*, Haw.
 2.—With the cuneiform spots strongly developed = sub-var. *lineolata*, Haw.

I.—Ground colour dull brown.

- a. Without pale costa.—With distinct transverse markings = var. *aquilina*, God.
 b. With pale costa.... { 1.—With distinct markings = var. *tritici*, God.
 = var. *fictilis*, Hb.
 2.—With indistinct markings = var. *aquilina*, Hb.

K.—Ground colour blackish-brown.

- a. Without pale costa. { 1.—With distinct transverse markings = var. *venosa*, St.
 2.—As in 1, but more ash-coloured var. *hortorum*, St.

- b. With pale costa.... { 1.—With ill-developed transverse markings
= var. *nigro-fusca*, Esp.
2.—With distinct markings = var. *gypætina*,
Gn.

L.—Ground colour black.

- a. Without pale costa.—With more or less distinct markings = var. *nigra*.

- b. With pale costa.... { 1.—With the costal streak ill-developed = var.
ocellina, St.
2.—With the costal streak well-developed = var.
costa-nigra.

A.—Ground colour pale slaty-grey.

a. var. *obsoleta*, mihi.—This very rare variety is of a pale grey colour, lightly dusted with slaty scales, there are no distinct markings, but there is the faintest possible trace of a basal line, and the orbicular and reniform are represented by being slightly paler than the ground colour. There is also a faint trace of the subterminal line. Hind wings pure white in the type, but those of both sexes vary slightly from pure white to white with the outer margin grey. Sub-var. *puncta-obsoleta*. Like the above but with a faint ochreous tint, and the lower part of reniform filled in as a small black dot. Hind wings of the male pure white, of the female, white with a dark grey outer margin and dark grey lunule. Both these forms are very rare, I have seen them from Deal only.

β. var. *costa-obsoleta*, mihi.—Of the same pale slaty-grey ground colour as in var. *obsoleta*, but with the costa dusted with still paler grey and the three stigmata outlined in paler, so that this form, although of the same obsolete character, has a distinct costal streak. There are indications of the cuneiform spots. The form is apparently very rare. I have it from Deal only.

γ. var. *nana*, Zell.—In the British Museum is a very small sub-var. of *costa-obsoleta* with Zeller's label. It is a ♀, with a costal streak developed, and paler stigmata; traces of a row of cuneiform spots. Hind wings grey with paler base; expanse not more than $\frac{3}{4}$ of an inch. I have an almost identical specimen from Deal, but it must be rare, as I have no other specimen. I do not know whether this variety has been described or whether it is simply a M.S. name found in Zeller's collection.

B.—Ground colour clear slate or dove-colour.

a. var. *cærulea*, mihi.—The ground colour of the anterior wings of a pale slate or dove-colour, which shows up most clearly on the inner margin, the median nervure, the costal area and between the (more or less) ill-developed cuneiform spots. The transverse lines edged with fuscous, the orbicular round and generally white (sometimes of the ground colour), the reniform also pale; the longitudinal area in which the reniform and orbicular are placed, slightly suffused with fuscous, and fuscous dots on the costa show the commencement of the transverse lines; the cuneiform spots blackish-fuscous. Hind wings greyish-white with dark outer margin. I have only seen this beautiful variety from Deal, and have no knowledge of its occurrence in other British localities. In its extreme form, this is the finest variety of the species I have ever seen.

β. var. costa-cærulea, mihi.—Of the same slaty ground colour as the last, but with a distinct pale longitudinal costal streak, distinctly pale median nervure, and a series of long, pale dashes between the cuneiform spots; the orbicular round and pale, the reniform ochreous, but outlined in pale; the spaces between and beyond the stigmata fuscous but very variable in intensity. The transverse lines also variable as to the extent of development, and fuscous costal spots represent their origin. In the type these lines are well developed, but in others entirely absent. Hind wings whitish, with dark grey margin, in some ♀'s entirely grey. I have had this form sent me from the Continent for *vitta*, Hb., but this can hardly be correct, although the slaty tinge was most distinct in the specimen called *vitta*, which I received. I have a sub-var. of this form *minor-cærulea* with all the characters of *costa-cærulea*, but not more than two-thirds of the normal expanse, some running under an inch in size, and thus forming an almost parallel variety to the *nana* of Zeller in the *obsoleta* series.

C.—Ground colour slaty-fuscous.

α. var. eruta, Hb.—This variety is an extreme form of *var. cærulea*, in which the slaty-colour, although still evident, is reduced to a minimum, and the fuscous colour begins to make itself particularly prominent. It is a fairly abundant variety at Deal, although apparently rare enough in most other British localities. I have received it from the Swiss Alps. It appears to be fairly well distributed on the Continent, especially at moderately high altitudes. It also occurs occasionally in British localities other than Deal, but compared with the brown and fuscous forms appears to be generally rare. Hübner describes it as:—"Anterior wings pale greyish-brown, the orbicular small and white, the reniform dark-centred, with fine blackish transverse lines, and dotted with white towards the hind margin. The hind wings whitish-grey shaded with darker" ('Sammlung europäischer Schmet.', p. 181). Hübner's fig. 623 of the same work may be described as follows:—"The anterior wings greyish-brown, shaded with red-brown; two basal streaks of paler grey shaded with dark brown, the orbicular and reniform both outlined in paler, a dark shade from the base of the reniform to the inner margin, a pale wavy line outlined in darker directly beyond the reniform, whilst another near the hind margin forms the base of five wedge-shaped marks; the extreme outer area dark brown. The hind wings grey, base paler, lunule distinct." The purple tinge sometimes seen on this variety appears to be due to the combination of the slaty colour in group B, with the dark-brown with which the ground-colour is shaded. Dr. Staudinger says of the variety:—"Magis unicolor." There is a considerable amount of variation in the development of the stigmata and transverse lines, but I would include all those specimens which generally satisfy the description under this name.

β. var. vitta, Hb.—Staudinger treats this as a distinct species and he may be correct. Guenée treats it as a var. of *aquilina*, which, even if *aquilina*, Hb. were admitted to rank as a species, must be incorrect. For myself, I have varieties of *tritici* taken at Deal identical with Hübner's figures, whilst some so-called *vitta* received from Dr. Staudinger, in no way resemble Hübner's figures, although still practically indistinguishable from other Deal varieties. Hübner's

fig. 533 (the type) may be described as:—"♂. Anterior wings brown with a purplish or reddish tinge; median nervure white; costa whitish with a distinctly pink tinge, but extreme border of costa dark; stigmata paler but the space between darker. Hind wings whitish-grey." His fig. 534 "is a ♀ and has the costa whiter and broader than in 533 and no dark edge. There is an ill-developed row of cuneiform spots in both 533 and 534. Hind wings with a dusky lunule and margin" ('Sammlung europäischer Schmet.' &c.). As the Continental *vitta* appears to be the pale costa form, allied to the non-pale-costa variety known as *eruta*, it may be advisable to keep the name for this form. The ground colour is normally brownish-red with a slaty tinge, particularly well-developed about the paler areas of the wing as the costal streak, median nervure, &c.

D.—Ground colour greyish-white.

a. var. pallida, mihi.—The ground colour pale greyish-white, with none of the slaty colour characteristic of *var. cærulea*; the abbreviated and complete basal lines edged with fuscous; the stigmata are represented by clear, very pale spots standing out in the ground colour; the elbowed line pale; the extreme hind margin beyond the subterminal line dark grey; traces of the row of cuneiform spots just inside the subterminal line. Hind wings whitish, darker outer margin. There is sometimes a pale ochreous tinge to be seen in the whiter ground colour, but this represents by far the palest variety of the species we obtain in the British Islands. My specimens have come from Deal and I have not received it from other localities.

β. var. sagittifera, Stphs.—The following is the description of Stephens' *sagittifera*:—"Head and thorax griseous mixed with white; anterior wings griseous clouded with white, with a longitudinal, black, arrow-shaped line at the base; the anterior stigma is rather elongate, ovate, whitish, with the centre pale ashy-brown; the posterior, griseous in the centre, margined with dusky and white; the space between, as well as at the base of the anterior stigma, deep fuscous; the teliform stigma is rather elongate and has a slender black streak extending from it; on the hinder margin is an angulated pale stripe, having a few dusky wedge-shaped lineolæ within; the margin itself has a row of minute black dots; on the costa near the apex is a fuscous spot in which are three white dots; the posterior wings are whitish with the margins dusky; the ♂ has the posterior wings milk white." A figure of this variety is given in Humphrey and Westwood's 'British Moths.' There are so many minor differences in the specimens with a whitish-grey ground, that I would include under this name all those specimens whitish-grey in colour, with a pale costal stripe and pale longitudinal central line, with a more or less well-developed fuscous blotch between the reniform and orbicular.

γ. sub-var. obsoleta-pallida, mihi.—There is a sub-var. of *sagittifera* with the same pale greyish-white ground colour, but with the dark fuscous space between the stigmata, characteristic of *sagittifera*, undeveloped. The ordinary transverse lines are also practically undeveloped and the variety exhibits a great tendency for the markings to become obsolete. It is in fact (except in colour) a variety almost parallel with sub-var. *costa-obsoleta* in group A, but has of course no slaty colour. My specimens of this variety have come from Deal.

This would appear to be the var. B of Guenée's 'Noctuelles', vol. v., p. 288, where we read:—"This is the opposite to the preceding (var. A). The inferior wings are almost as white as in *aquilina*, even in the ♀, with a blackish border, very decided, and divided in its inner half by a white band. The superior wings are very much powdered with white, above all on the costa, extending to the stigmata and the sub-terminal space, but the terminal space is very dark. The thorax and the head are greyish-white." Guenée then goes on to say:—"I have taken this beautiful variety in the west of France. I have never seen it in collections nor have authors referred to it."

E.—Ground colour pale greyish-fusca.

a. var. *fusca*, mihi.—The anterior wings of this variety are of a pale greyish-fusca, with the transverse lines and stigmata well marked and generally outlined in darker fuscous. The stigmata vary in size and shape, and the row of cuneiform dashes on the sub-terminal line also varies in the amount of development, although this is never, in this variety, so obsolete as in Guenée's *siliginis*. There is no pale costa. The hind wings are whitish in the males, greyer in the females, but slightly variable *inter se* in the sexes. This variety is well distributed. I have specimens from the coasts of Lancashire and Yorkshire as well as from Deal. This would appear to be Guenée's var. C, of which he writes:—"The superior wings a little larger, of a pale greyish-brown, shaded with darker grey, with the lines deeper; the cuneiform spots not very distinct. Inferior wings equally pale" ('Noctuelles,' vol. v., p. 289).

β. var. *siliginis*, Gn.—This variety has puzzled a good many lepidopterists, even its nomenclator Guenée, who did not consider it near enough to *eruta*, Hb. to sink it as that form, consequently he treated it as a distinct species. Zeller's specimens in the British Museum show that the variety is closely allied to var. *eruta*, having a fuscous ground colour, but with the upper half of the wing strongly dusted with pale greyish-white to below the stigmata; the transverse lines being very indistinct, except the subterminal, which is pale grey. The hind wings are of a dirty white colour. Guenée writes of it:—"Each French author has written this name in his own fashion. M. Duponchel writes "*seliginis*," M. Boisduval, "*segnilis*." To the remark I have made on this subject ('Ind.,' 240) I would add, that if a rectification in the name were necessary, it would probably consist in adopting Hübner's name, but I am not at all satisfied that his *eruta*, in spite of its resemblance to this, is anything but a simple variety of *tritici*" ('Noctuelles,' vol. v., pp. 287-288). Staudinger considers *siliginis* as synonymous with *eruta*, but it only agrees with it in having no pale costa, in fact, Staudinger considers every var. of *tritici* without a pale costa as synonymous with *eruta*, an evident error. It is really only a sub-variety of var. *fusca*, differing from it in the fact that, whilst the former has the transverse lines strongly developed, this has them ill-developed or not at all. In this way it is nearest to var. *obsoleta* in group A, but the colour is very different.

γ. var. *costa-fusca*, mihi.—This is the pale greyish-fusca form, in which the transverse lines and row of cuneiform spots are well-developed, and differing from var. *fusca* in the presence of a very distinct costal streak and pale median nervure. It is a common and

well-distributed form, and only differs from the type in being paler. There is, as in all the varieties of *tritici*, a great deal of minor variation, and *subgothica*, Haw. is one of these named forms, differing only from this variety, in having the spaces between the orbicular and reniform and beyond the orbicular, very dark, and in being without the row of cuneiform spots generally present in var. *costa-fusca*.

δ. var. *subgothica*, Haw.—The diagnosis of Haworth is as follows:—"Alis griseo-fuscis, costa late at dimidiatim, stigmatibusque pallidis." "Præcedentibus (*sagittiferus*) affinis absque punctis posticis sagittatis. Stigma anticum subtriangulare, posticum reniforme: ante et inter hæc arcus niger qui reversus apparit in alis expansis. Stigma teliforme prægrande a basi fere ad medium, sed lineolis duabus divaricatum transversis interruptum. Posticæ pallidæ fimbriâ fuscâ." "Habitat in Anglia valde infrequens" ('Lepidoptera Britannica,' p. 224). The variety is figured in Humphrey and Westwood's 'British Moths,' Pl. xxiv., fig. 1, and in the same work we read:—"Anterior wings grey-brown, with a broad pale stripe running within the costa nearly half along the wing. The anterior stigma is nearly triangular, and the posterior one is reniform; the space before, between and behind which, is black, or dark brown. The teliform stigma is very large and extends to the base of the wing, but is interrupted by two pale oblique divaricating stripes; the centre of the spaces between the veins behind and before the outer stigma, is marked by dusky patches, and the apical margin of the wing is very irregularly brown; the costa itself is marked with numerous blackish dots. The posterior margin of the wing is also marked with a long dusky streak. The hind wings are pale, with a slight central lunule and a dusky border. The abdomen is pale, but rather fulvous towards the tip." A great deal of error has arisen in connection with the synonymy of this sub-variety of Haworth. In America, it has been used as the name of a closely allied species, which is called *subgothica*, Haw. Unfortunately, Mr. A. G. Butler uses the same synonymy in the 'Trans. Ent. Soc. of London' (1889), p. 377, and in the 'Entomologist's Record and Journal of Variation', vol. i., p. 10, I called his attention to this with other errors. The *subgothica* of Haworth refers to some British species, for he speaks of it as "Habitat in Anglia valde infrequens" ('Lep. Brit.', p. 224), but the insect known as *subgothica*, Haw. in America is not British, therefore the American species will have to be called *subgothica*, Grote (or by some other nomenclator's name), certainly it is not *subgothica*, Haw.

F.—Ground colour dark greyish-fuscous.

α. var. *sordida*, Haw.—Haworth's diagnosis of this variety is as follows:—"Alis fusciscentibus strigis quatuor submoniliformibus pallidis." "Antennæ pectinatæ. Præcedenti (var. *obeliscata*) affinis at alæ minus rufæ, strigis quatuor conspicuis pallidis nigro vel fusco utraque et subundulatum marginatis, et inde moniliformibus; duabus ante, tertiâ pone, stigmata. Quarta striga juxta marginem posticum, undata ex punctis confluentibus subflavis. Macula triangularis fusca ante, alteraque tetragona inter stigmata. Stigma tertium fere ut in ultima, at pallidius. Alæ posticæ albicantes, fimbriâ, lunulâ medio, venisque fuliginosis" ('Lepidoptera Britannica,' p. 222). This is one of the commonest varieties of the species found in Britain, being well-dis-

tributed, and occurring in most of the localities whence I have obtained the species. This is closely allied to the next, which has the transverse markings less distinct and the central area paler.

β. var. pupillatus, Haw.—Haworth's description of this species is as follows:—"Alis fusciscentibus stigmatibus ordinariis subocellatis, stigmatique tertio teliformi sesquialtero." "Alæ fusciscentes strigis duabus subflexuosis, et inter hac color pallidior, stigmata 2 subocellata, lineolaque brevis duplex sesquialtera e media striga anteriori oriente" ('*Lepidoptera Britannica*,' p. 118). Bentley writes of it:—"Anterior wings fuscous with four transverse strigæ; the first at the base, the second before the anterior stigma, the third behind the posterior, and the fourth near the hinder margin; the costa is spotted with dusky and white, the space between the second and third strigæ rather pale; stigmata pale, anterior ocellated" ('*Entom.*' vol. i.). Bentley's description of *pupillatus* agrees more with the last var., *sordida*, so far as the transverse lines are concerned. Haworth mentions only two transverse lines, and appears to make a special point of the central space between the basal and elbowed lines being paler.

G.—Ground colour pale yellowish-ochreous.

a. var. ochracea, mihi.—The anterior wings are of a pale yellow-ochreous colour, generally with the transverse lines distinct, outlined with darker, the stigmata pale and well marked; but there is considerable variation in the development of the cuneiform spots, which are much more distinct in some specimens than in others. The hind wings undergo a similar range of variation to all the other varieties of this species. It is a rare variety. My best examples have come from Deal and Shoeburyness.

β. var. detorta, Ev.—In the British Museum collection are two specimens from the Zeller collection, of a pale ochreous (reddish-tinted) colour with distinct transverse lines; the costa distinctly pale, light brownish in colour. Hind wings grey, those of the male paler at base. Guenée's South American var. *D* would appear to come close to this. He writes of it:—"It comes near our var. *C* (*fusca*), but the ground colour is more obscure, with a reddish tint; it has no cuneiform spots; the space between the ordinary stigmata is blackish. The inferior wings are almost as dark as in var. *A*" ('*Noctuelles*,' vol. v., p. 289).

H.—Ground colour reddish-brown.

a. var. valligera, Haw.—Haworth's diagnosis of this variety is as follows:—"Alis rufo-fuscis stigmatibus tribus, strigaeque postica cuneorum fuscorum." "Ultima (*sordida*) satis differt in strigis longe obscurioribus, et in striga postica ex maculis acutissimis cuneiformibus fuscis. Maculae fuscae ad stigmata pallida ut in præcedente. Alæ posticae albæ, margine venisque fuliginosis. Fœmina magis grisea antennis setaceis, absque fuscinedine ante et inter stigmata. Alæ posticae minus albæ" ('*Lepidoptera Britannica*,' pp. 222-223). Haworth also adds:—"Either this or *albilinea*, if memory deceives not, is the *Phalœna tritici* of the Linnean cabinet, but probably not of his works." This is another well distributed variety in the British Isles, occurring freely on the coast of Lancashire, near Sligo, at Deal, and in many other localities. At Sligo, the red-brown forms appear to predominate over all others, although the costal-streaked varieties—*albilinea* and *lineolata*—are more abundant than the unstreaked forms.

β. var. cuneigera, St.—This variety is described as follows:—"Anterior wings of a reddish-brown colour, with the three stigmata distinct, but with the transverse strigæ rather obscure, and a row of acutely wedge-shaped brown spots within the apical margin. There is also a brown triangular-shaped spot before, and another, square in shape, between the stigmata. The hind wings are white, with the margin and veins dusky. The ♀ is more griseous in colour, without the brown spots before and between the stigmata, the hind wings are more dusky, the stigmata are extremely variable in shape, the anterior one varying from triangular to circular" (Humphrey and Westwood's 'British Moths,' p. 120). This is very closely allied to the former, but the markings are less distinct; like it, however, it has no pale costal streak. It is also well distributed.

γ. var. albilinea, Haw.—Haworth's diagnosis is as follows:—"Alis rufescentibus stigmatibus tribus strigaeque postica cuneorum nigrorum, lineaeque alba longitudinali." "Præcedenti (*var. valligera*) nimis affinis. Differt in coloribus saturatoribus, et præcipue in linea rectissima tenuissima alba, a basi alæ per basin stigmatum aliaque albida crassior etiam a basi alæ per apices stigmatum. Macula cuneata atra pone, alteraque tetragona inter stigmata albida medio cinerea. Stigma teliforme margine atro conspicuum" ('Lepidoptera Britannica,' p. 223). This is a very abundant variety of *tritici* in some localities, more especially on the coast near Sligo, where the bright red forms have been obtained by Mr. Percy Russ in very considerable numbers. The specimens, however, are generally small from this locality. A fair percentage of the specimens obtained by Mr. Baxter at St. Anne's-on-Sea (Lancashire) are also of this form. I have a long series of large, well-coloured specimens from Deal. This is undoubtedly Hübner's *aquilina* ('Sammlung europäischer Schmet.', fig. 536), which has:—"The anterior wings dark red-brown, with costa white from base to the reniform, median nervure also white; stigmata pale; two dark dashes on the costa are the commencement of the basal streak; claviform nearly black. Hind wings white with a darker outer margin." I have also had this variety sent me for *aquilina* by Continental lepidopterists.

δ. var. lineolata, Haw.—Haworth's diagnosis of this variety is as follows:—"Alis rufescente subfuscis stigmatibus tribus, strigaeque postica lineolarum nigrarum." "Præcedenti (*albilinea*) simillima, at satis differt longitudine stigmatis teliformis, et potissimum, in striga postica nec cuneorum circiter septem, sed lineolarum nigrarum confertarum, circiter duodecim" ('Lepidoptera Britannica,' p. 223). Bentley writes of this variety:—"Anterior wings reddish-brown with a white streak upon the costa extending from the base beyond the middle; the central nervure of the wings is white, between the stigmata is a quadrate black spot, the teliform stigma small and black; near it is a pale transverse striga; on the posterior margin is a row of wedge-shaped spots and a white waved striga. Posterior wings cinereous with dusky markings" ('Entom.,' vol. i.). This is so close to the last that it really cannot be considered as a distinct variety. Haworth points out above, only two minor and unstable characters by which it may be distinguished.

I.—Ground colour dull brown.

a. var. aquilina, God.—The *aquilina* of Godart (Pl. 64, figs. 6 and 7) is a brownish var. of *tritici* without a pale costa. It may be described as having “the anterior wings dark smoky-brown without a pale costa, two basal transverse strigæ and two beyond the reniform paler; the orbicular and reniform also paler; the claviform of the ground colour; a row of cuneiform dashes parallel to the hind margin.” In the text we find:—“Superior wings blackish-brown with a more or less reddish tint, with two black, undulated transverse lines bordered with grey, enclosing, besides the two ordinary stigmata, a black oblong ring (claviform), which adheres to the anterior line. Ordinary stigmata whitish, with brown centres. Immediately beyond the posterior black line is a space clearer than the rest of the wing, in which are placed some black wedge-shaped streaks. Following this is a whitish wavy transverse line, which is immediately followed by a paler one parallel to the hind margin. Hind wings whitish with the outer margin darker.” He then adds:—“There are specimens with the costa sprinkled with greyish-white atoms, but these never form a costal band, distinct from the ground colour as in *vitta*” (‘Histoire naturelle’ &c., p. 218). This is a not unusual variety, and I have a remarkably fine series from Deal, some of the specimens being extraordinarily large and fine, but it is not at all unusual to take it in other localities where the species is common. It must not be confounded with *aquilina*, Hb., which is of the same ground colour but with a costal streak.

β. var. praticola, Hb.—This is a variety with no pale costa, and closely allied to vars. *eruta* and *cuneigera* according to Zeller’s specimens in the British Museum collection, which are browner than *eruta*, of the same shade as Hübner’s *aquilina* but without the costal streak of the latter. *Praticola*, Hb. is given as a variety of *obelisca* by Guenée. The determination of Zeller is wrong, as may be seen by reference to Hübner’s figure which has a faint costal streak:—“The anterior wings are of a brownish-grey colour with a slight reddish tinge, with an abbreviated, followed by a complete, double, transverse, basal line; claviform outlined in black, reniform and orbicular outlined in pale with a dark quadrate spot between them; a pale transverse, elbowed line (beyond reniform) outlined in black (both sides), hind margin clouded with darker. Posterior wings whitish, outer margin dark grey” (‘Sammlung europäischer Schmet.’ fig. 567, ♀).

γ. var. ficitilis, Hb.—This is represented by Hübner’s fig. 479, which may be described as having “the anterior wings reddish-brown with a pale brown costa; pale stigmata; a dark space between the stigmata, and another just outside the reniform, dark claviform; lower part of basal area also darker; double wavy transverse line and four cuneiform spots between reniform and outer margin. Hind wings pale at base, darker on hind margin with no spots” (‘Sammlung europäischer Schmet.’ &c.). Geyer’s fig. 710 in the same work, represents the same form, but is rather redder, with a red costa and less suffused; the hind wings white with a dark marginal streak, dark nervures and lunule. It is most certainly a var. of *tritici*, and better marked than the true *aquilina* of Hübner. It is, however, the clearly marked brown form with a costal streak, which passes in England for

aquilina, and which stands in most collections as such. The true *aquilina* is a duller, more obsoletely marked form and comparatively rare in Britain. I have a long series of *fictilis* from Deal. Guenée writes of *fictilis*:—"It does not merit a varietal name, and only differs from the type (*aquilina*), in having the stigmata more distinctly separated, and the latter being preceded and followed by black. The claviform stigma is filled in with the same colour. It is astonishing how M. Boisduval has referred this variety to *tritici*" ('Noctuelles,' vol. v., p. 289). It is more astonishing to me how *aquilina* was considered a distinct species, although Guenée was undoubtedly correct in referring *fictilis* rather to *aquilina*, since it was considered a species, than to *tritici*. The *tritici* of Godart and Duponchel must undoubtedly be referred to this variety. It is "dull brown in colour, with a distinct costal streak, two transverse basal streaks, one abbreviated, the other nearly complete (except at costa); claviform black, orbicular black-centred, reniform of the ground colour. Between the reniform and orbicular, a black patch, and between the orbicular and base, resting on orbicular, a black wedge-shaped spot. Hind wings dark grey, base paler, dark nervures" ('Histoire naturelle' &c., Pl. 65, fig. 5).

δ. var. *aquilina*, Hb.—The type of *aquilina* is represented by Hübner's fig. 135. "The anterior wings of a dull dark brown, of a still darker shade just outside the reniform and between the stigmata; a dark streak under the median nervure at the base; the costa pale brownish; five cuneiform spots parallel to the hind margin. Hind wings with a dark marginal line, dark nervures and lunule" ('Sammlung europäischer Schmet.' &c.). Hübner's figs. 535 and 536, also called *aquilina*, are entirely different forms of *tritici*. His figure 535 has the anterior wings dull brown, with a broad yellowish costal streak; white median nervure; two black costal dashes show the commencement of the basal streak; orbicular indistinct but paler, reniform also paler, the space between these dark brown; costa, at apex, dark brown; narrow elbowed line; outer space beyond subterminal line darker, with four cuneiform spots on subterminal. Hind wings white with a slight ochreous shade on hind margin. The figure 536 of the same work, must undoubtedly be referred to var. *albilinea*, Haw. This dull and badly marked form is rather rare in England, although, in the course of some years, I have taken several specimens at Deal.

K.—Ground colour blackish-brown.

a. var. *venosa*, Stphs.—"It differs from *cuneigera* in being more dusky, in appearing more irrorated with dark specks, and having the base of the anterior wings considerably varied with dark marks and waves, the supplemental stigma is wanting, the dark spaces near the ordinary stigma are here visible, a much-waved pale striga runs from the hind part of the posterior stigma, and there is a sub-marginal undulated striga preceded by black wedge-shaped marks; the body and hind wings are like those of *cuneigera*. Taken in Cumberland and near Edinburgh, in July" ('Humphrey and Westwood's 'British Moths,' p. 120). It is considered as a var of *cuneigera* in this work. These blackish-brown specimens are much more common in some localities than others. At Deal, I have obtained some very fine forms which I have never obtained elsewhere, but some of the varieties sent out by the Aberdeen collectors are much like them, and must be included under the same varietal name.

β. var. hortorum, Stphs.—This is also considered as a var. of *cuneigera* in Humphrey and Westwood's 'British Moths,' where we read:—"Fore wings deep dusky ash, with four transverse paler strigæ, the three anterior of which are edged with dusky and placed nearly as in *tritici*, but the posterior one is less undulated, and has a row of elongated dusky or black streaks attached to the anterior edge as in *cuneigera*; on the hinder margin is a row of minute black spots; the usual stigmata are faintly rufescent and margined with black; the third is very slender, and the black margins alone are visible; the posterior wings are fuscous, with the nervures and margin darker. Body deep fuscous. Taken in August, at Whittlesea Mere." It must be borne in mind that these forms with the cuneiform spots well developed, but with no pale costa, were looked upon as distinct but allied species, by our early authors, and that, of these, *cuneigera* was treated as the type, as having these characteristic streaks more distinctly developed. The forms are not uncommon in many British localities.

γ. var. nigro-fusca, Esp.—Esper's diagnosis of this variety is as follows:—"A. spirilinguis cristata, alis superioribus fuscis, margine crassiore dillusiori, stigmatibus ordinariis, minimis albidis, macula rhomboidea intermedia, strigæque baseos nigris; inferioribus albidis, limbo nigricante" ('Die Schmet. in Abbildungen' &c., p. 383). His figure 6, Pl. 127, is of a dull purplish-brown with a pale costa; a large wedge-shaped black spot contains the reniform and pale orbicular; the lower half of a transverse, black, basal streak is traceable; also a pale central longitudinal line; a transverse row of linear marks where cuneiform spots are generally developed. Hind wings dark grey. This dark form in which the transverse markings are but ill-developed is found occasionally in all localities, but is nothing like so generally distributed as are the fuscous and reddish-brown varieties. I have specimens from Deal, the Lancashire coast and Aberdeen coast. All these dark blackish-brown specimens have a purplish gloss on them, the black group (L) being also well tinged with the same shade.

δ. var. gypætina, Gn.—This would appear from Guenée's description to be a variety of this species. His description is:—"Superior wings of a brownish-black, tinted slightly with violet, with the costa broadly white from the base almost to the angulated line, broken by black streaks which form the commencement of the transverse lines; base of the median nervure equally white; the two stigmata concolorous in the centre, but preceded, separated and followed by black. The three first lines paler (almost white) than the ground colour, especially the abbreviated and complete basal lines, which are much angulated except at the top; the subterminal line, preceded by small cuneiform streaks, almost absent. Inferior wings white, with the edge and nervures strongly powdered with blackish" ('Noctuelles,' vol. v., p. 290). This description, taken from two fine male specimens captured at Monte Video, would appear to belong to this species, and appears to be not unlike some of the darker varieties captured in Britain. This fine and distinctly marked variety is not very common in most localities, although I have received very well marked specimens from the Aberdeen and Lancashire coasts, and have occasionally taken them at Deal.

L.—Ground colour black.

α. var. nigra, mihi.—Absolutely black varieties of *tritici* are rare,

but occasionally occur. In some of these the transverse lines are more distinctly marked than in others, and they generally have a distinct purplish tint, due perhaps to a reddish colour being present with the black. Under this name I would include all those varieties which have the anterior wings black, with the transverse lines more or less distinct, but without a pale costal streak. I have only varieties of this form from Deal. This would appear to be Guenée's *tritici* var. A, of which he writes:—"Superior wings more blackish, more speckled, in no way reddish, with the lines and stigmata almost concolorous and differing but little from the ground colour. Inferior wings also darker and only a little clearer on the disc." "All the specimens which I have seen have come from Valais, but it certainly ought to be found elsewhere" ('Noctuelles,' vol. v., p. 288).

β. var. ocellina, St.—This is the *ocellina* of Stephens, not the *ocellina* of Hübner, which is a distinct species. Stephens' description is:—"Anterior wings dusky or blackish, with a short ashy streak upon the costa, and two black transverse strigæ, the first before the anterior stigma, the second behind the posterior; near the hinder margin is a pale waved striga; anterior stigma—ocellated" (Bentley, 'Entom.,' vol. i.). This is not such an uncommon black form as the last, as many of the blackest specimens appear to have faint traces of a paler costal streak. I have such black varieties from Deal and Aberdeen.

γ. var. costa-nigra, mihi.—Anterior wings black, with a distinctly paler longitudinal streak, and paler median nervure. The stigmata generally well defined, with traces of the basal, elbowed and subterminal transverse lines. This variety is closely allied to var. *gypætina*, Gn., and I have only seen specimens from the coast near Aberdeen.

Besides the classified varieties, the following have been described, but do not appear to belong exactly to any of those named.

α. var. vittu, Esp.—Esper's diagnosis of this variety is as follows:—"Alis incumbetibus fusciscentibus, margine crassiori, stigmatibusque albidis, maculis, interiacentibus angularibus, binisque baseos nigris" ('Die Schmet. in Abbildungen' &c.). His fig. 6, plate 143, may be described as—"Fuscous-brown with whitish costal streak and central nervure; lower half of transverse basal line developed; orbicular surrounded with white, reniform outlined in paler; dark transverse angulated line outside reniform, and a dark fuscous shade on hind margin. Hind wings white with grey outer margin." Guenée writes:—"The colour is still blacker than var. A (of *aquilina*), with the stigmata, the costa and the median nervure of a greyish-white, very marked, and which shows up still more distinctly the black which separates the stigmata from each other and from the claviform" ('Noctuelles,' vol. v., p. 290). This would therefore appear to be a sub-variety of var. *nigro-fusca* of the same author.

β. var. domestica, Fab.—Fabricius' diagnosis of this is as follows:—"Noctua lævis alis incumbetibus cinereis nigro strigosis: costa basi nigro apice albo punctata." To this he adds:—"Statura quadripunctata. Corpus hirtum cinereum. Alæ anticæ cinereæ strigis undatis, nigris, in medio maculæ ordinariæ: anteriore nivea, posteriori reniformi: costa punctis septem nigris, tribusque albis. Posticis subtus albidæ puncto medio strigæque fuscis" ('Entomologia Systematica' &c., No. 48, p. 23).

γ. var. *virgata*, mihi.—This is a variety which I can hardly pass without mention. It belongs so far as the ground colour is concerned to the C group, but differs from any of the varieties there mentioned in having a distinct, dark, central band between the basal and elbowed lines. The ground colour is of a pale ochreous tinted with reddish, with the basal lines very pale, the abbreviated one with a fine black edging on one side nearer the base. The space between the complete basal and elbowed lines is of a deep reddish-brown, the claviform is black and well developed, the orbicular, round and of a very pale grey, the reniform also pale, with an almost white outline; the subterminal line is well marked, and the row of cuneiform spots fairly well developed. The hind wings are pale whitish-grey with the outer margin darker. I have two specimens taken at Deal. This is so very distinct a form, and the central band so remarkable, that it at once attracts attention, and is undoubtedly one of the finest varieties of the species I possess.

Agrotis, Och., *agathina*, Dup.

Godart and Duponchel describe the type of this species as follows:—"The superior wings are the colour of wine dregs, with two grey undulated transverse lines, of which the one nearer the outer edge is accompanied with 7 small black arrow-shaped or cuneiform streaks. The two ordinary stigmata are generally well marked in greyish, and separated by a black or dark brown space. The orbicular, of elongated form, is placed obliquely and is united to the upper branch of a grey bifurcating line which starts from the base of the wing; the fringe is blackish. The inferior wings are of a yellowish-grey colour with the fringes paler and spotted with grey" ('Histoire naturelle des Lep. de France,' vii., p. 359). They also give a figure (plate 122, fig. 2) of the species which represents the colour as "slaty-grey, with two short, white, longitudinal basal streaks, the upper one bifurcating, the top branch touching the orbicular; a waved white transverse basal line, reniform and orbicular outlined in whitish; the elbowed and subterminal lines whitish; a row of cuneiform dashes on the latter. Hind wings pale grey, darker on the outer margin, a pale line running through the darker part parallel to the hind margin." The figures, however, are frequently none too good in this work. Besides this reddish-grey form there are two distinct varieties, one, of a bright rosy colour with the characteristic markings, the other, with the ground colour almost blackish (var. *scopariæ*). Both forms occur in Britain, the former, more especially in our southern counties, the latter, in Scotland. The species has a pale costa, and shows considerable response in its coloring and markings to its environment among the *Calluna* and *Erica* on which it is found.

α. var. *scopariæ*, Mill.—Millière's description of this variety is as follows:—"It is a little smaller than the type, but the variety differs from the type in the following manner,—(1) by the deeper tone, almost black,—(2) by the smaller size of the ordinary stigmata,—(3) by the complete absence of the transverse line on the inferior wings, which, however, is well developed on the underside. These three essential characters, which do not vary, are insufficient to form in this darker race of *agathina*, a species distinct from the type. It is also the opinion of M. Guenée, who, by-the-by, recently informed me that he had received from the north of Britain, varieties of this *Agrotis* identical with mine,

'Only,' added he, 'this dark coloration is explained by the climate of Scotland; it is curious that the same modification is produced in the warmest part of France' (*in litt.*). The ab. then, comes, not only from Provence, since it has also been found in the north of Great Britain" ('Iconographie et Des. de Chen. et Lép. inédits,' ii., p. 151). This is Guenée's variety **A**, of which he writes:—"The superior wings are straighter and less rounded on the outer margin; they are very dark, almost black, with some clearer spaces reddish; of which the three most distinct ones are behind the reniform, and two others on the inner margin outside the median lines; the markings are very indistinct, especially the subterminal line, which is only represented by some clear parts; the inferior wings are entirely blackish and only a little clearer in the centre; the thorax is darker." He then adds:—"This remarkable variety, which is perhaps a distinct species, was sent to me by M. Donzel, who took it at Hyères. Unfortunately I have no more specimens of it to compare with a very large number of *agathina*" ('Noctuelles,' vol. v., p. 294). Staudinger, in his 'Catalog,' p. 81, simply says of it:—"Obscurior."

β. var. rosea, mihi.—The anterior wings of a bright rosy tinge, with the markings otherwise as in the type, the transverse lines, stigmata and row of cuneiform spots being developed equally well. It is the more common form in the south of England.

Agrotis, Och., subrosea, Stphs.

This species, so nearly allied to *vestigialis* and *obelisca*, is generally placed in the genus *Noctua* in England. The richly coloured British type, unknown on the Continent of Europe, and unhappily supposed to be extinct here, is of a rich rosy-grey, almost, in some specimens, rosy-brown. The darkest Continental specimens, although approaching the palest known British examples, form on the whole a very distinct race. These ashy-grey, often almost lilac-tinged specimens, are known as *var. subcærulea* on the Continent. The type is described and figured in Stephens' 'Illustrations,' p. 200, pl. xix., fig. 1, also in Newman's 'British Moths,' p. 351, where it will be noticed that the pectinated antennæ and characteristic pale costa of the *tritici-obelisca* group, remove it from our restricted genus *Noctua*. In Humphrey and Westwood's 'British Moths,' p. 126, we read:—"This very distinct species differs from the remainder of the genus (*Graphiphora*) in the strongly pectinated antennæ, as well as in the large size of the under wings. It measures from $1\frac{1}{2}$ to $1\frac{2}{3}$ inch in expansion of the fore wings, which are of a brownish-grey tinged with rosy; the costa with several dusky spots, two undulated but rather indistinct strigæ towards the base of the wings, a triangular brown patch preceding the basal stigma, and another more oblong between it and the hinder stigma, which is grey with the centre darker, the latter succeeded by a very curved row of dots, sometimes connected by lunules, beyond which is a dusky submarginal irregular stripe; the apical margin paler, dotted with dusky. The hind wings very pale ashy-buff, with a broad apical dusky fascia. The antennæ in the male are strongly bipectinated to the tip, and fulvescent, those of the female very slightly ciliated." Guenée writes of the type:—"Superior wings of a rosy-grey, with the lines fine, dentate, and indistinct; the subterminal line pale, slightly waved and shaded anteriorly with rosy-brown. The

two median stigmata pale, incomplete (blending in their upper parts with the costal area, which is paler than the ground-colour), darker in the centre, separated and preceded by black or reddish-brown; the origin of the transverse lines forming black streaks on the costa. Inferior wings ochreous-white, with a blackish lunule and indistinct subterminal band." "The two sexes are very similar in colour, but the male has the antennæ strongly ciliated, which separates this species from its neighbours" ('Noctuelles,' vol. v., p. 333).

a. var. *subcærulea*, Stdgr.—This name was given by Dr. Staudinger to the variety figured by Herrich-Schäffer under the typical name *subrosea*. His diagnosis is:—"Al. ant. cærulescentibus" ('Catalog,' p. 80), and he gives as localities "Livonia and Finland." The difference between British and these north Continental specimens is almost identical with that in the species *hyperborea*, in which the same ashy-grey colour of the Scandinavian and Finland specimens is replaced by brown and red in ours. Herrich-Schäffer writes:—"Herr Kefferskein sends me under this name *subrosea*, another species from Lapland. It is as large as *festiva*, of a light ashy-grey colour, the claviform reddish-brown, both the ordinary stigmata pale-grey, &c." ('Systematische Bearbeitung' &c., p. 59). The same author figures both sexes. Fig. 516 is "a male, with the anterior wings purplish-grey, with a pale-grey costa, and single costal streaks at the commencement of the transverse lines, which are reddish; a dark (reddish-brown) quadrate spot between stigmata extending to a point beyond the orbicular; the median nervure white; the space directly below the stigmata reddish; the space between the elbowed and subterminal lines purplish; area outside subterminal, grey. Hind wings orange-grey with a distinct lunule. Fig. 622, ♀. Colour greyer, less red than in fig. 516, with a central transverse grey shade extending under quadrate spot to inner margin; costa almost unicolorous with rest of wing. Hind wings grey, base paler" ('Systematische Bearbeitung' &c., figs. 516 and 622).

Agrotis, Och., *corticea*, Hb.

This is another excessively variable species, and has the different varieties much more closely interwoven than in the allied *exclamationis*. As in that species the ground colour varies from pale grey to black, but reddish-brown forms are comparatively rare, probably owing to the darker forms being so thickly irrorated with black atoms that they become rather black than brown. There are the four ordinary transverse lines, but these are much more often obsolete in this, than in the allied species. The stigmata vary very much both in size, shape, and intensity of colour, the orbicular is sometimes a pale grey circle or oval outlined in black, but more generally ocellated, whilst sometimes it is entirely black. I have never seen a specimen with it entirely absent, although it is often very indistinct and merges into the ground colour; the claviform varies in size, shape and intensity, but generally has a pale centre. In ground colour we find the prevailing shades whitish-grey (putty-coloured), fuscous or smoky-grey, brown with a slight reddish tinge and black. In some specimens, there is a clear whitish ground colour with obsolete lines and distinct stigmata, but generally the grey forms are much irrorated with black dots; probably the two most striking forms are those in which the grey colour is restricted to the central band, the basal and outer areas being

black, the other, in which the opposite conditions take place, the central area being black, and the basal and outer areas grey, unless indeed a black form with a pale brown extreme outer margin is still more striking. The grey and black varieties are not difficult to classify, but the fuscous and brown forms are very puzzling. The hind wings of the male vary from whitish-grey to dark grey; nervures slightly darker; lunule variable in intensity but generally distinct. Those of the female are dark grey; nervures dark, lunule generally distinct. Incidental varieties occur pretty freely, *e.g.*, the dark forms generally have the transverse strigæ very indistinct, but occasionally one gets a black form with the pale transverse lines standing out strikingly pale, while again, some of the dark forms have the nervures very pale, thus giving the specimens a very characteristic appearance. Classifying the varieties we find the following are the most striking forms:—

A.—Ground colour whitish-grey.

- 1.—Transverse lines more or less obsolete, sometimes entirely so, stigmata distinct, not irrorated with black scales = var. *clavigerus*, Haw.
- 2.—Transverse lines distinct, stigmata distinct, much irrorated with black scales especially along the costa = var. *irrorata-pallida*.
- 3.—Basal and outer areas black, central area (containing stigmata) pale whitish-grey = var. *virgata-pallida*.
- 4.—Basal and outer areas pale grey, central area black = var. *sincerii*, Frr.

B.—Ground colour fuscous or smoky-grey.

- 1.—Transverse lines more or less obsolete, sometimes entirely so, stigmata distinct, not irrorated with black scales = var. *obsoleta-fusca*.
- 2.—Transverse lines and stigmata distinct, much irrorated (especially costal area) with black scales = var. *irrorata-fusca*.
- 3.—Transverse lines and stigmata suffused and almost lost in the unicolorous ground colour = var. *subfuscus*, Haw.

C.—Ground colour reddish-brown.

- 1.—Transverse lines and stigmata distinct, slightly irrorated with black scales = var. *brunnea*.
- 2.—Transverse lines and stigmata distinct, ground colour pale brown, costal area dark reddish-brown = *corticea*, Hb. (the type).
- 3.—Much suffused with black scales, transverse lines and stigmata very indistinct = var. *suffusa-brunnea*.
- 4.—With brown basal and outer areas and black central band = var. *obscura*, Freyer.

D.—Ground colour black.

- 1.—Black, with pale brown extreme outer margin = var. *brunnea-virgata*.
- 2.—Black, with paler veins = var. *venosa*.
- 3.—Black, with pale transverse lines = var. *transversa*.
- 4.—Entirely black, with still more intense stigmata = var. *nigra*.

The above list will be found to contain the greater number of our varieties, but there are so many intermediate forms that it is impossible to classify them all. Hübner's type has the "anterior wings of the ground colour pale brown, with a very slight reddish tinge. A tiny

dark basal streak close by the thorax is followed by another basal streak in which the claviform is outlined in a darker colour; the orbicular small and outlined in paler, as is also the reniform; a very indistinct pale line just beyond the reniform, and another pale line parallel to the hind margin. Costal area from base to apex very dark brown; also dark on hind margin. Hind wings dark grey, no lunule" ('Sammlung europäischer Schmet.' fig. 145). The hind wings of all the varieties are practically alike, those of the males being grey, and those of the females but little darker in colour.

A.—Ground colour whitish-grey.

a. var. clavigerus, Haw.—This is described by Haworth as follows:—" *Bombyx*. Thorace albo griseoque, alis griseo-pallidis, stigmatibus intus griseis extus atris, alis posticis cinereis." "Antennæ ferruginæ, stigma anticum griseum atro late cinctum; stigma reniforme ad strigam posticam attingens. Thorax fuscescens. Alæ posticæ cinerascens lunula media, venisque saturatoribus" ('Lepidoptera Britannica,' p. 114). He also adds a var. β ., of which he writes:—"Stigmate antico subocellari, seu annulari, puncto atro pro pupilla." The pale whitish-grey varieties included in this name, vary slightly *inter se*. Although equally pale, some of the specimens have quite distinct basal and angulated lines, whilst others are completely without them. All however, with scarcely an exception, have fairly well-developed stigmata, although there appears to be an endless variation not only in shape but in the way they are outlined and filled up with a darker shade. All my specimens of this variety have been captured at Deal.

β . var. *irrorata-pallida*, mihi.—This variety has the same pale greyish ground colour as the last, but is irrorated with blackish scales, so that it appears to be slightly darker. The typical transverse lines are generally more distinct than in *clavigerus*, and the stigmata well marked, there are often also traces of a series of short dark dashes near the outer margin. The hind wings grey as in the type and the other varieties. A sub-variety of this form occurs, in which the costa is intensely black, the inner margin being of the typical coloration. This I would call *costa-irrorata*.

γ . var. *virgata-pallida*, mihi.—With the ground colour of the anterior wings pale greyish, but with the basal and outer areas black; the central area thus shows up as a pale central band containing the stigmata. This is a very rare variety. My specimens, as is the case with most of my best varieties, have come from Deal.

δ . var. *sincerii*, Frr.—This is precisely the opposite in the arrangement of colour to the last. The pale ground colour in this remains at the base and outer margin, leaving the central area irrorated with black scales, so as to give it the direct appearance of a dark central band. Freyer's description is as follows:—"Colour like that of *A. corticea*; fore wings, body and fringes, light-brown, tending towards grey. The central area is much darker, and enclosed by two semi-curved bands; another darker, suffused band runs from the tip, near the outer margin to the inner margin; stigmata scarcely visible, the orbicular being the darkest. Hind wings whitish, with darker shades near the outer margin" ('Neuere Beiträge' &c., p. 101).

B.—Ground colour fuscous.

a. var. obsoleta-fusca, mihi.—This is the clearest or most obsolete variety, with the ground colour of the anterior wings of a smoky-grey colour. The basal, angulated and subterminal transverse lines more or less obsolete, but the stigmata distinct, the ground colour not irrorated with black scales. I have this and the following varieties from many localities in England, also from the east coast of Scotland.

β. var. irrorata-fusca, mihi.—This has the ground colour of the anterior wings as in the last variety, but the whole area of the wing irrorated with blackish-scales, the costal area being particularly so, the basal, angulated and subterminal transverse lines distinctly developed, as also are the stigmata.

γ. var. subfuscus, Haw.—Haworth's description is as follows:—" *Bombyx*. Thorace cinereo atroque vario, alis fusco-griseis, stigmatibus ordinariis atris, alis posticis fuscis." "Præcedenti (*clavigerus*) valde affinis. Alæ anticæ fuscae tinctura grisea, strigis fere oblitteratis, stigma teliforme seu tertium fusco griseum cincto atro. Stigma reniforme ad strigam posticam attingens ut in præcedente. Alæ posticæ fuscae lunula media saturatiore" ('*Lepidoptera Britannica*,' p. 114). This is closely allied to the preceding, but the fuscous scales here are so numerous as almost to conceal the ground colour, and the stigmata, though still distinct, do not stand out conspicuously as in the paler varieties.

C.—Ground colour reddish-brown.

a. var. brunnea, mihi.—The anterior wings with the ground colour reddish-brown, generally more or less irrorated with fuscous scales, with the transverse lines and stigmata distinct. This is very close to the type, which has a pale brown ground colour, the costal area being of a dark reddish-brown, giving it almost the appearance of a costal streak. The *sordida* of Hübner would appear to be a sub-variety of *var. brunnea*. Hübner's figure may be described as:—"Anterior wings uniform brown; two double basal lines, darker on outside; three stigmata also outlined in darker; elbowed line fuscous; space outside subterminal line dark grey. Hind wings dark grey, base paler" ('*Sammlung europäischer Schmetz.*,' fig. 154). It will be seen that this only differs from *brunnea* in its dull colour and dark outer margin.

β. var. suffusa-brunnea, mihi.—This also has the ground colour of a reddish-brown, but suffused with black scales, so that the transverse lines and stigmata are very indistinct, owing to the suffusion.

γ. var. obscura, Freyer.—This is a var. of *corticea*, figured and described by Freyer who writes:—"The ground colour is dark brown with a central band." His Plate 628, figs. 1 and 2, also represent this variety. Fig. 1 is a male, with "the anterior wings dark brown, with an abbreviated, followed by a complete basal line, the central area (including the stigmata) crossed by a blackish-brown band, extending from the complete basal line to the elbowed line and from the costa to the inner margin; transverse black line parallel to the hind margin; hind wings grey, paler at base, with darker nervures and lunule. Fig. 2 is a female, like fig. 1 (♂), but ground colour darker, with ordinary transverse lines somewhat paler" ('*Neuere Beiträge*' &c., p. 51, Plate 628, figs. 1-2). This variety is parallel with *var. nigra*-

virgata, but has a brownish instead of the greyish ground colour of the latter. It is a very distinct variety, and Freyer's figures are particularly good.

D.—Ground colour black.

a. var. brunnea-virgata, mihi.—This variety has the anterior wings black in colour, with the outer margin beyond the subterminal line of a bright ochreous or pale brown. In the 'Entomologist,' vol. xxii., p. 15, is a record of the capture of this variety near Ely.

β. var. venosa, mihi.—This is another rare development of the species; the anterior wings black, but the nervures standing out conspicuously in a paler ochreous colour.

γ. var. transversa, mihi.—This is a more common black variety than either of the two preceding. The ground colour of the anterior wings is black, but the transverse lines are paler, and hence stand out conspicuously.

δ. var. nigra, mihi.—This is the most extreme form of the species, there being no paler markings whatever about the variety. The anterior wings are black in colour, the stigmata being noticeable in a still more intense depth of the same colour. The transverse lines are also traceable, owing to their deeper shade of colour.

Agrotis, Och., *exclamationis*, Linn.

This is another most variable species, both in the ground colour and in the development of the markings, especially the stigmata. The anterior wings have normally the four ordinary transverse lines in this group, and the three stigmata. The ground colour varies from a clear whitish-grey in two directions:—1st, through a bright reddish-grey to a deep red-brown, and 2nd, through a dark fuscous to a deep black-grey. In some specimens a shade runs along the costa, apparently obliterating the upper parts of the orbicular and reniform. But the most remarkable variation of this species is in connection with the stigmata. The claviform varies very much both in size and shape, but is usually black in colour; the reniform, usually badly developed in its upper part, is of some shade of grey, deepening in the dark varieties into reddish-brown or black, and occasionally sending out lineolæ into the orbicular or towards the outer margin; but the orbicular varies most, from a well developed, large oval or circular ocellated spot to entire absence, sometimes situated at some distance from the reniform, at other times in close contact. I have a specimen from Mr. Esson, taken at Aberdeen, without either transverse lines or stigmata. I have other specimens with the transverse lines and orbicular absent, but none so clear as the Aberdeen specimen. Fairly constant forms of variation are those, in which the orbicular and reniform are joined, forming a more or less continuous line, and where the claviform is joined to both reniform and orbicular. I have also a specimen in which the wings on one side are fairly normal, but on the other, the whole centre of the wing has a scorched appearance, or rather as if a pigment in the three stigmata had become wetted and thus run over the central area of the wing. The hind wings of the male are white, with faint traces of a marginal band in some specimens; nervures variable in intensity from dark grey to almost total absence; lunule sometimes faint, generally absent. In the female, they are dark grey, base slightly paler; nervures darker; lunule generally defined, sometimes very distinct.

With regard to the general variation of this species, Guenée writes:—"It varies prodigiously, but it is very difficult to classify the varieties, which are very inconstant. *Picea*, Haw., 170, appears to be a small variety of the female." "It (the species) is found in Canada without any modifications" ('Noctuelles,' vol. v., p. 280). In Humphrey and Westwood's 'British Moths,' p. 124, we find:—"This species is extremely variable in its colour as well as markings. The ordinary varieties of this species are very common." The classification of these various forms is a most difficult matter, but I propose only dealing with the most marked forms. The following table appears to cover most of these:—

- 1.—Ground colour of the anterior wings of the males pale whitish-grey, stigmata and transverse lines more or less distinct; in females, ground colour not quite so clear = var. *pallida*.
- 1a.—Ground colour grey, with distinct reddish costa = var. *costata*.
- 2.—Ground colour clear fuscous, central area rather paler, lines, &c., as in No. 1 = *exclamationis*, Linn.
- 3.—Ground colour black-grey, lines, &c., as in No. 1 = var. *picea*, Haw.
- 4.—Ground colour clear reddish-grey, lines, &c., as in No. 1 = var. *rufescens*.
- 5.—Ground colour dark reddish-brown, lines, &c., as in No. 1 = var. *brunnea*.

The above table is based on the ground colour of the anterior wings. Based on the character of the stigmata we get the following forms:—

- 1.—The 3 stigmata entirely or almost entirely absent = var. *obsoleta*.
- 2.—The orbicular absent, the other stigmata distinct = var. *unicolor*, Hb. (?).
- 3.—The orbicular and reniform joined, sometimes forming a straight line = var. *plaga*, St.
- 4.—The orbicular, reniform and claviform all united = var. *juncta*.

Of course combinations of any form of the first group may occur with any form of the second group, I would suggest the combination of the two names to distinguish these particular forms. One other striking form occurs worthy of a name. This is due to the stigmata, especially the reniform, breaking into lineolæ, which sometimes assume the form of a series of dark, vein-like longitudinal marks through the reniform area of the wing, as in fig. 1, p. 326, of Newman's 'British Moths.' Such specimens I have called var. *lineolatus*.

a. var. *pallida*, mihi.—The anterior wings of the males of a pale whitish-grey colour, the basal and elbowed lines fairly distinct, as also are the orbicular, reniform and claviform stigmata. The hind wings white. The females of this variety have the ground colour of a rather darker shade, and the hind wings also darker.

β. var. *costata*, mihi.—This variety has the anterior wings of a greyish ground colour, with the costa broadly reddish, the transverse lines and stigmata becoming obsolete in the costal area, but well developed in the central area and towards the inner margin. It is the var. *a* of Haworth, who writes:—"Alæ anticæ fuscæ vel fuscescentes costâ subinde tincturâ purpurei. Striga basi imperfecta repanda nigra, interdum pallido adnata; altera simillima ante medium quæ exserit

stigma teliforme nigrum vel atrum: tunc stigma anterius ordinarium annulare pupillâ nigrâ: tunc reniforme latum, vel fere cordiforme etiam nigrum: tandem striga arcuata denticulata extus pallida; denique striga quarta undata itidem pallida juxta marginem posticum, quæ subinde evanescit. Alæ posticæ maris, albæ costâ margineque cinereis, ciliis lutescentibus; feminae fuscae basi cinerascens" ('Lepidoptera Britannica', pp. 219-220).

γ. var. *picea*, Haw.—This is described by Haworth as:—"Noctua. Alis piceo-nigricantibus stigmatibus ordinariis rotundatis nigris." "Præcedenti (*exclamationis*) nimis affinis. Differt, longe minor, alis saturatioribus absque strigis Stigmata duo antica oblonga; tertium stigma subrotundum, nec ullo modo reniforme vel cordiforme. Posticæ alæ omnino fuscae ciliis albis. Exemplarium unicum feminae solum vidi" ('Lepidoptera Britannica,' p. 220). In Humphrey and Westwood's 'British Moths,' we read:—"Picea, Haw. is a black form of the ♀, and has the fore wings of a pitchy-black colour without strigæ, and with the two basal stigmata oblong and the outer one round and black. The hind wings are brown."

δ. var. *rufescens*, mihi.—This, probably, is one of the commonest varieties of the species. It is certainly Haworth's var. β, of which he writes:—"Alis rufescentibus, posticis feminae basi albis" ('Lepidoptera Britannica,' p. 220). The anterior wings are of a clear reddish-grey, intermediate in shade between the grey of var. *pallida*, and the dark reddish-brown of var. *brunnea*; the transverse lines and stigmata are generally clearly and well developed in both sexes, but the hind wings of the females are darker than those of the males.

ε. var. *brunnea*, mihi.—This is undoubtedly the var. γ of Haworth, who writes:—"Alis utroque sexu longe saturatioribus strigis magis oblitteratis, posticis feminae perfuscis, basi cinereis" ('Lepidoptera Britannica,' p. 220). This is another common variety, the anterior wings of a dark reddish-brown, much darker than in var. *rufescens*, with very dark strigæ and stigmata, sometimes not so distinct as in the paler varieties; the hind wings also comparatively dark.

The following varieties are based on peculiarities in connection with the stigmata:—

α. var. *obsoleta*, mihi.—The anterior wings of a pale greyish-brown without any transverse lines or stigmata. A specimen of this variety was sent to me for examination last year (1890) as a new *Leucania*, so deceptive was its superficial appearance. This was taken at Dulwich. I have a specimen in my collection perhaps not quite so pale as the one just mentioned, but equally clear as to the absence of the markings. This latter was taken by Mr. Esson at Aberdeen. These are the only specimens I have seen of this perfectly obsolete variety.

β. var. *unicolor*, Hb.—I believe this to be a var. of *exclamationis*. Hübner's figure may be described as follows:—"Fore wings dark reddish-brown with the discoidal stigmata outlined in dark. Hind wings grey, the outer margin reddish, nervures almost black" ('Sammlung europäischer Schmetz.,' fig. 544). My specimens, which I refer to this variety, are of a reddish-brown; somewhat similar to var. *obsoleta* in the absence of transverse strigæ, with the orbicular absent or imperfectly developed, but the other stigmata distinct. Guenée refers Hübner's *unicolor* to *aquilina*, but Treitschke considers it a var. of *exclamationis*.

γ. var. *plaga*, St.—This is described as follows:—"The ordinary stigmata and strigæ are obliterated, the place of the former being occupied by a very faint brown dash, whilst the teliform stigma is distinct and elongated into a stout, deep, black, longitudinal dash towards the inner margin, and above one third of the length of the wing" ('Illustrations of Brit. Ent.,' 388). It will be thus seen that this variety has no transverse lines, and that a single line replaces the ordinary orbicular and reniform stigmata, whilst another replaces the teliform. I have specimens taken at Deal in 1888.

δ. var. *juncta*, mihi.—A sub-variety of the last, in which the three stigmata are all united in the form of black streaks, one streak replacing the orbicular and reniform, another, the claviform stigma. This is not at all a common development. I have specimens from Deal and Greenwich.

ε. var. *lineolatus*, mihi.—This strange aberration is figured in Newman's 'British Moths,' p. 326, fig. 1. The peculiar development consists in the formation of lineolæ running out from the reniform stigmata and others taking the place of the cuneiform spots. Some specimens show the development much better than others, but I would include all forms showing this peculiarity under this name.

Agrotis, Och., *ripæ*, Hb.-Gey.

This is another remarkably variable species, the specimens varying from pure white or whitish-ochreous with the faintest possible traces of stigmata, to dark grey with well-marked transverse lines and stigmata. Normally, there are in this species (as in the *obelisca-tritici* group) four transverse lines, the outer being very faint and sometimes forming a series of pale dots; there are the ordinary three stigmata, but these are generally very faint, although the intensity varies much, and occasionally one or more of them may be remarkably well developed. All the different varieties occur in both sexes, and the females are, as a rule, rather larger than the males. The first specimens I received of this species were from Mr. Harwood. They were very large and most of them very pale. I then received specimens from the Yorkshire coast, much darker, although almost as large, whilst specimens received from the Lincoln coast appeared to be very small compared with these, but were, nevertheless, darker than any I previously had. This small darkest form I found, on reference to Hübner's 'Schmetterlinge' &c., was the true type. His figure 702 may be described as:—"Male, anterior wings with costal area slaty-grey, inner margin brownish-grey with a reddish tinge; there are two double basal lines; the claviform is represented as a short black mark, the reniform and orbicular pale, outlined in black; an indistinct wavy line just outside the reniform, and a row of seven small, black wedge-shaped spots on a pale transverse line parallel to hind margin; a short costal streak just outside the reniform. Posterior wings white with a row of faint blackish dots on nervures." Fig. 703 is the underside of 702, and has a transverse line on each wing, and a reddish central spot. The description of fig. 702 exactly agrees with some of my Lincoln coast specimens, and these alone (with the exception of two Yorkshire specimens) show any really good development of the wedge-shaped spots. It is rarely, too, that dots are developed on the hind wings, although some of my specimens show distinct traces of

them. The hind wings of the male are white, nervures slightly darker, occasionally with a trace of a transverse row of black dots, lunule indistinct; of the female, the hind wings are variable in colour, from white to dark grey, lunule generally distinct, but sometimes faint or absent. The stigmata of the anterior wings are strikingly variable. I have specimens in which the claviform is a short fine black line, others, in which it is blunt with a pale centre, others, in which a faint brownish outline indicates its position, and one in which it is practically absent. The orbicular varies from a minute dot or total absence to a large circular or oval stigma outlined in black or pale brown and sometimes ocellated; the reniform is also variable both in shape and colour; in some specimens, it is of the ground colour surrounded by paler, in others, it is dark grey outlined in blackish, with every intermediate form. Guenée does not seem to have seen the type from his statement ('Noctuelles,' vol v., p. 284):—"Not having seen specimens from the Baltic, I do not know exactly what separates them from var. *desillii*. If it is necessary to compare it with Hübner's figure, and above all, with that of Freyer, these differences would be considerable." The second figure in Newman's 'British Moths' shows a remarkable development of the dusky nervures, which are developed also in some other species of the genus, vide, *A. segetum* var. *venosus*. The species was taken at Portland in 1890, by Lieut. E. W. Brown, and, among his specimens, were some beautiful examples, many almost white, others cream-coloured, whilst others were more ochreous, but none came near the type. Of these he writes:—"The handsome cream coloured *ripæ* occurred at Portland in the same locality as the darker forms" (*in litt.*). Like *tritici*, *cursoria* and *obelisca*, this species has distinct "pale-costa" and "non-pale-costa" forms, some of the latter being very striking.

The following is an attempt to classify the principal varieties:—

- 1.—White, with faint ochreous tinge, stigmata and transverse lines indistinct = var. *obotricica*, Schmidt.
- 2.—White, with faint ochreous tinge, stigmata and transverse lines distinct = var. *weissenbornii*, Frr.
- 3.—Pale ochreous, with reddish tinge, indistinct transverse lines and stigmata = var. *desillii*, Pier.
- 4.—As in No. 3, but with white costa = sub-var. *albicosta*.
- 5.—Pale greyish, inner margin reddish-ochreous, distinct transverse lines and stigmata = *ripæ* (type).
- 6.—Pale greyish, without the reddish area under the stigmata, base and outer margin fuscous = var. *nebulosa*, St.
- 7.—Pale greyish, with indistinct transverse lines and stigmata = var. *desertorum*.
- 8.—Reddish-brown, with distinct transverse lines and stigmata = var. *brunnea*.
- 9.—Dark greyish, with a slight slaty tinge; much suffused = var. *grisea*.

I am quite aware of the incomplete character of the above table, but *ripæ* is one of those species which I have never found abundantly myself, and I have therefore had to rely on the comparatively short series in my collection.

a. var. obotrictica, Schmidt.—Anterior wings of a clear white ground colour, with a faint ochreous tinge under the stigmata and towards the inner margin; faint traces of the basal, elbowed and sub-terminal lines and stigmata, generally of an ochreous tint, are present. Hind wings pure white. This is an almost unicolorous white form, and I have only seen specimens from Portland. I have other specimens, but, beyond that they came from the south coast of England, I have no knowledge of their exact locality. Like *desillii* of Pierret, this name really includes a group of local forms, forming a local race of a white ground colour, of which Freyer's *weissenbornii* is a particular form, and included in the general notes of Herr Schmidt, though without reference. Since Freyer's special name for the more strongly marked white form takes precedence of Schmidt's name, I would restrict the latter to those almost unicolorous white specimens, mentioned by him and not referred to by Freyer. Schmidt's note on the subject is as follows:—" *Agrotis obotrictica*. This beautiful moth appears in July, and becomes the more interesting since it resembles *ripæ*, Tr., Hüb. and H.-S., *dev(s)ilii*, Pierr. and *deserticola*, Ev. so much, and yet the specimens differ again like the others among themselves, which makes it doubtful whether all these belong to one species and are local varieties, or whether they are different species. This moth varies in colour and markings from a pure white ground with indistinct spots to partly yellowish with more or less distinct markings, yet the moths remain very plain and pale even in the darkest specimens; on the whole, there is much more white than in any of the allies, and it differs most from the yellow *deserticola*. It is also considerably larger than *dev(s)ilii* and *ripæ* from Königsberg. Hering and others take this form for a distinct species. He named them after the old Mecklenberg race "*obotrictica*." Lederer considers them all as belonging to one species, and mine as var. *obotrictica*. Hering and Herrich-Schäffer, who, through me possess the most varied deviations, have not expressed an opinion so far as I know. To the want of knowledge of the life history of all these allies and the scarcity of specimens in collections, is attributable the difference of opinion; then again, as a local form, it agrees with many species of *Agrotis*, and this, therefore, is not reliable. It is to be hoped, that further researches will lead to an ultimate decision " ('Stett. ent. Zeit.', 1858, p. 377). The forms above treated by Herr Schmidt as distinct, are now well known to be variations of one species, of which *ripæ* is the type, and *obotrictica* is simply one in a long series of intermediate forms, leading from specimens which are pure white to others which are deep blackish or slaty-grey.

β. var. weissenbornii, Fr.—Freyer's *weissenbornii* may be described as having the "anterior wings of a pale whitish-ochreous ground colour, with a single transverse basal line; claviform of ground colour, outlined in black; the circular orbicular and reniform also similarly outlined. Hind wings white with ochreous tinge" ('Neuere Beiträge' &c., p. 140 and plate 466, fig. 3). Of this variety Staudinger in his 'Catalog,' p. 86, simply writes "albicans." This form is taken at Portland with the previous form, probably also in other localities.

γ. var. desillii, Pier.—In Duponchel and Godart's work we find:—"Here is the description given by M. Pierret in the 'Ann. Ent. Soc. Fr.,' 1839, p. 95:—"The superior wings are of a reddish-grey, some-

times a little yellow, with three undulated, whitish transverse lines, more or less bordered with brown. The exterior of these lines is toothed. The orbicular stigmata are small, of an ashy-brown colour, the reniform is margined by a more or less distinct whitish line, the claviform is narrow and short; a little outside the exterior line one notices a transverse series of white dots, each placed between two black points, sometimes very indistinct. The posterior border is marked with a transverse series of black spots. The costa is sometimes ashy-grey, sometimes white enough to contrast strongly with the ground colour; the nervures ordinarily white, but sometimes grey outlined with brownish. The inferior wings white in the males, brownish in the females, but paler towards the base, with darker nervures. The external edge of the wing presents a dark brown line, going in an attenuated form almost to the abdominal margin where it disappears'." Duponchel then adds:—"This beautiful variety of *ripæ* was found for the first time in 1837, in the environs of St. Saviour-le-Vicomte, in Normandy, by M. Bottin-Desilles. He obligingly sent me a fine specimen of each sex" ('Histoire naturelle' &c., iii., p. 476). Of this variety Guenée writes:—"Not having seen the Baltic specimens (referred to the type), I am not able to define the differences which separate them from var. *desillii*. The differences in the figures of Hübner and Freyer appear to be very considerable" ('Noctuelles,' vol. v., p. 284). Staudinger simply writes of this variety in his 'Catalog,' p. 86, "flavescens."

It will be seen from the above, that M. Pierret's description is a very comprehensive one, comprising as it does both "pale-costa" and "non pale-costa" forms. I have the pale ochreous-red form without the pale costa, from South Wales and the Devon coast. This form is erroneously named as the type in the British Museum collection.

δ. var. *albicosta*, mihi.—This is practically included in the *desillii* of Pierret, who describes reddish-ochreous forms, with and without a pale costa, under the same varietal name. The anterior wings are of a pale reddish-ochreous colour, with the basal and肘ed lines fine, single, and fuscous in colour, the extreme outer margin beyond the subterminal line being very pale; the claviform, orbicular and reniform very indistinct, traces of a row of cuneiform markings. Hind wings white. I have this form from the South Devon coast.

ε. var. *nebulosa*, St.—This variety is described as follows:—"Fore wings of a pale hoary or whitish-grey; the costa slightly clouded with fuscous, with a cloud of the same hue at the base of the wings, divided from the teliform stigma by a very obscure, waved transverse striga; anterior stigma round, small, its centre and margin dusky; posterior, reniform clouded with fuscous and black; behind this is an arcuated submoniliform striga, beyond which, the rest of the wing is deep fuscous, with an undulated white striga composed of approximating wedge-shaped spots; in the margin itself is a series of minute, black, subtriangular dots; cilia pale ash. Posterior wings of the male, pure white; of the female, nearly of an uniform pale cinereous, with the stigmata and costal spots nearly obsolete. Taken near Barnstaple, in July, 1827" ('Illus. Haust.' &c., 2, pl. xxii., fig. 1). This is a sub-var. of the type, agreeing with it except that it has no reddish tint to the inner margin, and therefore has the ground colour entirely grey. The costa, and basal and outer areas are clouded with fuscous.

ξ. var. *desertorum*, Bdv.—The specimens in the British Museum collection under this name, are of a pale greyish-white, very slightly ochreous; almost unicolorous with the exception of the orbicular, reniform and outer margin, which are rather darker; the subterminal line composed of pale dots. The specimens came from Sarepta. Guenée describes the type as:—"Superior wings narrow, of a greyish-white powdered with blackish scales, with the two median lines, distinct, blackish; the elbowed line faintly toothed; the complete basal line irregular and broken; the claviform, small, short and indistinct; the two median stigmata blackish and more distinct, the reniform usually surrounded with black; the subterminal line absent or indistinct, a terminal series of black dots; fringe concolorous. Inferior wings pure white without markings. Antennæ a little more ciliated than in *ripæ*." "Southern Russia" ('Noctuelles,' vol. v., p. 284). This is treated by Guenée and Dr. Staudinger as a distinct species, but there appears to be no doubt of its being a local form of *ripæ*.

η. var. *brunnea*, mihi.—The anterior wings of a deep reddish-ochreous tint approaching brown, the ordinary transverse lines and stigmata distinctly marked and fuscous; the row of cuneiform spots fairly well developed. Hind wings whitish, sometimes with a grey margin. That a "pale-costa" variety of this brown form occurs, appears probable, but I have never seen one. My specimens of var. *brunnea* came from the Yorkshire coast.

θ. var. *grisea*, mihi.—Anterior wings of a dark grey, much suffused with blackish scales, the whole area with a slight slaty tinge; the transverse lines and stigmata fuscous, but scarcely traceable owing to the depth of the ground colour; a row of small whitish dots takes the place of the subterminal line. Hind wings whitish. My specimens came from the Lincolnshire coast.

Agrotis, Och., *spinifera*, Hb. (?), Gregson.

There is a well known continental species of *Agrotis*, called *spinifera*, Hb., found, according to Dr. Staudinger, "in Sicily, Spain, and central France" ('Catalog,' p. 86). A specimen of *Agrotis*, now in Mr. Sydney Webb's collection, captured in the Isle of Man by Mr. Gregson, was recorded as *spinifera* by the latter, and of this specimen Mr. Webb writes:—"There is no doubt that the *spinifera* in my cabinet is abundantly distinct from any of our accepted British species. The fore wings are similar to those of *puta* as to length, but the hind wings are pure white, without a trace of colour either on the margin of the wings or fringes. The stigmata of the fore wings are outlined in dark brown upon the pale ground colour, and probably it was named from the shape of the claviform, which is very long, somewhat sword-shaped; a dark streak on the disc connects the reniform and orbicular; some dark dashes proceed inwards from the dark marginal line" (*in litt.*). Of the European species of this name Guenée writes:—"It is always a very great rarity. The only female that I have seen is decidedly larger than that of Hübner" ('Noctuelles,' vol. v., p. 265). Hübner's figure thus referred to by Guenée, has the "anterior wings brown with pale ochreous markings; a pale ochreous streak just under the costa from the base to the apex; an ochreous patch just under the base of the median nervure reaching to the inner margin and the

ochreous basal transverse line; reniform with an ochreous outline, orbicular entirely ochreous, both standing on the ochreous median nervure; all the nervures ochreous outside the reniform to the outer margin. Hind wings pure white" ('Sammlung europäischer Schmet.,' fig. 389). The figure, to me, looks more like a *Leucania* than an *Agrotis*.

Agrotis, Och., *puta*, Hb.

The type of this species is represented by Hübner's fig. 255, but it is rather a difficult species to deal with, owing to its (the type) being found so rarely in Britain and on the Continent. Guenée, in his 'Noctuelles,' vol. v., p. 266, says:—"It is necessary to bear in mind that the type of this species is not the variety we get in France. The type is very rare, and its precise habitat is not known." The British specimens are much like the French, and very rarely approach Hübner's type in colour. It has "the outer half of the anterior wings strongly tinged with red, the fringes pale, the basal half dark bluish-grey, a short, black, longitudinal basal streak followed by a wavy transverse line, orbicular and reniform distinct; a transverse shade from costa to inner margin between the stigmata; a double waved line beyond the reniform, three short wedge-shaped streaks on the outer margin near the apex. Hind wings grey, pale at base, fringes paler" ('Sammlung europäischer Schmet.,' fig. 255). In Godart and Duponchel's vol. ii., pl. 67, fig. 7 of the 'Histoire naturelle,' &c., we find a specimen figured as *puta* of a reddish tint; and with regard to this specimen we find on pp. 243, 244:—"I only know this species by a single ♀. The superior wings are of a greyish-yellow, the hind wings of a yellowish-white with the posterior margin reddish." "I do not know where it is found, but I suspect in Southern Europe." It will be noticed that Godart's figure is "reddish" tinged, while he calls it "greyish-yellow" in his description. I have a single specimen from Deal tinged with red and marked almost exactly as in Hübner's figure, but I never saw another. The reddish-tinged type is called *erythroxylea* by Treitschke, who describes it as follows:—"Xylina. Alis anticis ex flavo albidis, margine anteriori externoque rufescentibus, macula reniformi obscuriore" ('Die Schmet. von Europa,' v., 3rd part, p. 31). In Britain we have two very distinct types, that captured near London (and probably in most inland localities) has a much more reticulated appearance than that from the sea coast in the south-east part of England, in which the ground colour is much clearer grey and less marked transversely. The former is the *radius* of Haworth, whilst the same form but with a transverse central shade between the stigmata is the *lignosa* of Godart. There is a great deal of sexual difference, the females being much darker than the males, and while some of the females are well-marked, with a clear pale costal patch between the stigmata continued almost to the inner margin as a transverse band, others are entirely black without any paler markings. Haworth describes the male as *radius*, Stephens describes the female as *radiola*. Of these Bentley wrote in the 'Entomologist,' vol. i.:—"Agrotis *radiola*, *radia*. The following varieties are taken near London, Stepney, and Epping Forest:—Var. 1, ♂.—Anterior wings ashy, with a large, quadrate, brown patch at the base, and one upon the costa united to the posterior stigma, behind which is a row of black dots, and near the posterior margin a row of whitish spots; anterior stigmata

obsolete; posterior wings white with dusky nervures. *Var. 2, radia*, ♂.—Anterior wings ashy-grey, with two large dusky spots upon the costa, the first at the base, the other beyond the middle; immediately under the basal spot is an undulated black striga extending to the inner margin; anterior stigma obsolete, the teliform small, acute and margined with black; the posterior, large and reniform, also margined with black; united to the costal spot behind, are three black lines, bifid towards the posterior margin, and a few undulations towards the inner margin; posterior wings ashy. This variety was bred by my friend Mr. Chant, from a larva found at Colney Hatch. It changed to a pupa on April 15th, and to the imago on the 28th of May following. *Var. 3, radiola*, ♀.—Anterior wings fuscous, with an ashy patch in the middle towards the costa, in which is placed the anterior stigma, shuttle-shaped and margined with white; posterior wings fuscous, base cinereous. *Var. 4*, ♀.—Anterior wings fuscous, with an ashy patch in the middle; stigmata indistinct; posterior wings silvery white. I obtained this variety from the cabinet of Mr. Stone. *Var. 5, radia*, ♀.—Anterior wings dark fuscous or blackish, anterior stigmata small and shuttle-shaped, posterior large and reniform; behind which is a light brown waved striga; posterior wings very dark fuscous. The characters of the two supposed species are completely linked in the five varieties described above, which certainly are but one variable species. *Observation*:—It is singular that this species should vary so much in the posterior wings in the same sex, as shown in vars. 3, 4 and 5; I have not observed this in any other species of the family." There is a great deal of variation in the hind wings of this species. Most of the males have white hind wings, but some have a dusky shade on the hind margin. In the females, the wings vary from pure white to dark grey. The white form in the female is, however, very rare.

The forms, therefore, that have to be dealt with are:—

- 1.— Suffused with red = the type = *puta*, Hb.
- 2.— { Clear grey with basal mark, no central shade, orbicular stigma indistinct or absent = *renitens*, ♂, Hb.
- 2.— { Dark grey, with basal area, stigmata and outer margin darker = *renitens*, ♀, Hb.
- 3.— { Grey, much reticulated with faint longitudinal lines = *radius*, ♂, Haw.
- 3.— { Brownish-grey, with central area paler = *radiola*, ♀, St.
- 4.— { Grey, with transverse shade between orbicular and reniform = *lignosa*, ♂, God.
- 4.— { Blackish-brown, with two black transverse bands = *lignosa*, ♀, Godart.
- 5.— Greyish-black, much obscured markings = *obscura*, ♂.
- 6.— Entirely black = *nigra*, ♀.

With regard to the development of the central shade it must be noticed, that, while in the type (♂) and var. *lignosa* (♂), the shade is between the orbicular and reniform, in many specimens the dark shade joins the dark costal spot in which the reniform is situated, and this makes a continuous transverse band across the wing. I have forms from Deal, exhibiting all these variations of character. The hind margin, too, varies, sometimes being very clear, at others much clouded with fuscous. The var. *obscura* is a male, with the ordinary suffused colouring of the female.

a. var. renitens, Hb.-Gey.—In Hübner's 'Sammlung europ. Schmet.,' figs. 715, 716, 717, we find the ordinary form of *puta*, as taken at Deal, under the name of *renitens*. The male (fig. 715) may be described as "pale grey with the faintest reddish tinge on the costa and hind margin; the upper half of the basal area black, followed by a double pale transverse line; orbicular indistinct with a pale central dot; reniform black; three short black costal streaks above reniform; faint wavy line beyond reniform; another black wavy line parallel to hind margin. Hind wings white, with indistinct lunule." Fig. 716 is the underside of 715. Fig. 717 is the female and has "the anterior wings with the basal area black, followed by a faint, double basal line; a black claviform; no orbicular; black reniform joined to costa by black marks; the space between the reniform and orbicular paler, but under these stigmata is a shade to inner margin, black; a black wavy line beyond reniform; hind marginal area, except a narrow space along the costa, dark; a faint row of dots and a transverse black line parallel to hind margin; a number of dark marks on extreme hind margin. Hind wings white, outer margin dark grey, lunule distinct." This clear variety of the male with no trace of central shade and the faintest possible tinge of red on hind margin is not uncommon at Deal. I have not met with it elsewhere.

β. var. radius, Haw.—This is the most common form in the Metropolitan district. It has the ground colour darker and a much more reticulated appearance than the numerous coast specimens I have seen; the orbicular, too, shows up clearly in the darker ground colour. Haworth describes it as:—"Alis grisescentibus, macula quadrata baseos, fimbriaque saturatoribus, in qua striga pallida punctorum sagittatorum." "Alæ superiores pallide fuscæ stigmatibus tribus; duobus anterioribus parvis radiiformibus; exteriore magno reniformi. Margo costalis aliquo fusco pallidoque punctata. Alæ posticæ albicantes" ('Lepidoptera Britannica,' p. 119). This variety has, near the outer margin, a well developed row of linear pale spots which form the bases of a row of dark wedge-shaped markings; the double row of black spots beyond the reniform, almost (and often entirely) absent in *renitens*, is in this variety well developed. The sub-varieties of our London variety, as given by Mr. Bentley, have been described previously. I have only taken this variety in Shooter's Hill Woods and Greenwich Marshes.

γ. var. lignosa, God.—Godart's *lignosa* is thus described:—"The superior wings are grey in the male and of a blackish-brown in the female, with two transverse undulated black lines, which enclose the ordinary stigmata, and a narrow black chevron. The ordinary anterior stigma is oval, filled in with a longitudinal black line and separated from the posterior by a transverse dark shade. The extremity of the wing, which has a reddish tint (particularly in the male), has, towards the margin, a transverse series of small whitish spots. Inferior wings white in the male with the fringe a little brownish. They are darker in the female with the base and fringe whitish" ('Histoire naturelle' &c., vol. v., pp. 241, 242). This variety is near Hübner's *renitens*, but has a central transverse shade not present in the latter, nor does the double row of black dots appear to be present. Dr. Staudinger says of *lignosa*:—"al. ant. obscuris." The variety occurs at Deal with *renitens*.

δ. var. *obscura*, mihi.—The anterior wings of the male dull greyish-fuscous, as in some of the females, with the basal area, and costal patch containing reniform, darker, scarcely a trace of the double elbowed row of black dots or the row of pale dots near the hind margin; hind wings not clear white as is generally the case with the males, but dull greyish-white. Altogether this is a most obscure and unicolorous male variety. Godart says:—"In the male the base of the costa is shaded with blackish, but sometimes individuals of this sex approach the colour of the females, as in fig. 440 *a* of Engramelle." I have only one specimen of this variety, which was taken with the other varieties at Deal. I have a ♀ from Deal of a much paler ground colour than males of this variety.

ε. var. *nigra*, mihi.—*Nigra* is the extreme form of the female, as *obscura* is the extreme form of the male. The ground colour black, with the transverse lines, reniform and orbicular, marked in with more intense black, no pale patches, but the orbicular marked out in pale. I have female specimens, in which even the orbicular outline is unicolorous with the rest of the wing. Hind wings dark grey with (generally, but not always) the base paler.

Agrotis, Och., *cinerea*, Hb.

The type of this most interesting and variable species was figured by Hübner. His fig. 155 may be described as a "♂, of a pale ashy-grey colour, with an abbreviated, followed by a complete, black wavy transverse basal line; no claviform; orbicular a tiny black dot; reniform outlined in black; a dark shade extends from the costa to the top of the reniform, and another from the base of the reniform to the inner margin; there is a wavy black line directly beyond the reniform, and a row of black dots parallel to the hind margin. Hind wings white, darker on outer margin." His fig. 156 is a ♀, and has "the anterior wings rather of a purplish than ashy-grey, much lined transversely with black. The extreme basal area is black, followed by a pale area through which the black transverse basal line passes; the orbicular absent, the reniform indistinct; a black transverse band extends from the costa to the inner margin between reniform and orbicular areas; directly beyond reniform a wavy transverse line, outlined broadly with pale on either side; this is followed by another broad blackish line, and then by a fine wavy line cutting off the hind marginal area. Hind wings grey, darker on margin, with distinct dark transverse line and lunule" ('Sammlung europäischer Schmet.' &c., figs. 155-156). Of this species Guenée writes:—"It varies much, above all the males, which are sometimes of a deep testaceous, sometimes whitish, sometimes tinted with reddish. *Obscura*, Hb., 157-490, is generally considered as a variety, but it is difficult to say precisely of what the variation consists" ('Noctuelles,' vol. v., p. 282). In our British specimens there appear to be two principal forms of the male—one, pale, without the transverse median shade (through reniform), the other, with this shade well developed—with every kind of intermediate form. The females also exhibit two principal forms—one, ashy-grey like the ordinary males, with the median shade as in that sex, the other, almost unicolorous blackish = var. *obscura* of Hübner. The median shade is always reddish, sometimes it contains the reniform, whilst at other times it passes between the stigmata

There is no claviform and frequently no orbicular. The hind wings vary very much in shade in both sexes, from a pure white to grey, and from total absence of markings to a distinct lunule, a transverse shade just within the lunule, and another parallel to the hind margin.

a. var. *pallida*, mihi.—The anterior wings of the same ashy almost lilac-grey colour as the type; the basal and elbowed lines black, but rather less strongly marked than in the type; the orbicular absent or very small, reniform distinct; the median shade almost entirely obsolete; the subterminal shade pale, lined on either side with a slightly darker shade. Hind wings slightly paler than in the type. I have received all my specimens of this pale form from the Sussex collectors. They are all males; I have not seen a female of this variety. A sub-variety of var. *pallida* occurs, in which the broad, strongly-marked median shade of the type is replaced by a clear, but much narrower, red median shade, forming a central band between the stigmata. It is thus intermediate between the type and var. *pallida*. This sub-var. I would call *virgata*. This sub-variety also has a dark reddish shade bordering the inner side of the subterminal line, and tending to develop into cuneiform spots.

β. var. *obscura*, Hb.—This is a dark variety of the species, generally, but not always, confined to the female, there being also a form of that sex with the median band exactly similar to the typical males. Hübner's ♀, called *cinerea* (fig. 156), is not at all like his type of the ♂ (fig. 155), but almost identical with his *obscura* (fig. 157), except that the latter is a little darker. Hübner's *obscura* may be described as:—"Anterior wings, deep, unicolorous, dull-brown, with two darker transverse basal lines; faintest trace of reniform; elbowed line black and wavy, subterminal line dark; a dark median shade between stigmata; the extreme outer margin a very little paler. The hind wings greyish-brown with a dark shade on the outer margin" ('Sammlung europäischer Schmetz.', fig. 157). This brown form with black transverse lines, median shade, and stigmata, is not at all an uncommon form in the female in England, the central banded type being the rarer form. In the male, however, it is much rarer. I have a male from Sussex nearly allied to Hübner's figure, but my almost unicolorous females are darker and much blacker. However dark these latter may become, the transverse lines and reniform stand out in still more intense black, whilst the normal red (in British specimens) of the median shade makes itself noticeable in the central area of the anterior wings.

Agrotis, Och., *candelarum*, Stdgr.

This species was named *candelarum* by Staudinger ('Catalog,' p. 82), taking as his type the *candelisequa* of Hübner (397), but sinking the latter name on the ground of there being another species of the name in *Agrotis*. We rarely (if ever) get anything so pale as the type in Britain, and our form (*ashworthii*) is often treated as a species distinct from *candelarum*. Of this Mr. Willoughby Gardner wrote:—"The species of *Agrotis* which it (*ashworthii*) most resembles is the Continental *A. candelarum*, Stdgr. This somewhat rare insect has a range across central Europe, from the Ural Mountains, through Poland, Germany and Switzerland, as far as the western provinces of France. The imago is not unlike that of *A. ashworthii*, but the fore wings are of a

more ashy-grey, varied with red. The larva, though different in colour from that of *ashworthii*, resembles the latter in having a series of deep black marks along its back, which are, however, arrow-head-shaped instead of square. It feeds on various low plants, such as golden rod and dock, the first named of which is included in the pabulum of *ashworthii*. It is possible, therefore, that the immediate ancestor of *A. ashworthii* may have been the European *A. candelarum*, though ours is now quite a distinct species from the Continental insect. Neither the larva nor the imago of *ashworthii*, as found in its Welsh mountain home, now shows the slightest inclination to "cast back" to an earlier type, such as *candelarum*; and indeed, in the course of a long experience of the insect, the writer has been struck by the very slight tendency to variation exhibited by our species" ('Entom.,' xxiii., pp. 7-8). Mr. Dobrée then writes:—"Mr. W. Gardner is justifiably enthusiastic over the beauty of *Agrotis ashworthii* ('Entom.,' pp. 5-8), but as to its individuality, it must be confessed that it is generally admitted to be merely an illustration of the melanism, so commonly occurring in Great Britain, of common Continental species, and by no means entitled to rank as a separate species. The typical representative, *A. candelarum*, Stdgr. (= *candelsequa*, Hb. 397), is of no rare occurrence throughout Europe." There appears to be a considerable range of variation in the British specimens of var. *ashworthii*, although Mr. W. Gardner does not seem to have met the varieties. Of this variation, based on the pick of Mr. Gregson's captures, and now in Mr. Sydney Webb's collection, the latter gentleman writes:—" *A. ashworthii* chiefly varies in the greater or less intensity of the dark cloud which crosses the fore wings between the stigmata. Sometimes this is only a narrow line (it then approaches the type), sometimes it swells out at the top so as to embrace both stigmata within its width (Doubleday's *ashworthii*). The pale ash-coloured wings are, however, more or less covered with dark scales, and in several instances these quite obscure all the markings except the still darker transverse lines, indeed, two would make good companions for *Viminia myricæ*. Mr. Gregson was especially proud of these dark specimens, and they are mentioned in the 'Young Naturalist,' September, 1888" (*in litt.*). Hübner's figure, taken by Dr. Staudinger as the type, may be described as:—"Anterior wings of a beautiful clear grey, with a slight slaty tinge, with an incomplete, followed by a complete, single, black, basal line, edged internally with paler; the orbicular and reniform are represented by clear pale grey spots; a darker grey, central, transverse shade between the stigmata touches the reniform; a wavy, black, single, elbowed line directly beyond the reniform; subterminal line grey, outer margin rather paler than ground colour. Hind wings grey (slightly brownish), base paler" ('Sammlung europäischer Schmet.' &c., fig. 397).

a. var. signata, Stdgr.—The name *signata* is given to Guenée's var. A ('Noctuelles,' vol. v., p. 324). It is described as:—"Paler, of a reddish tint on the disc. Transverse lines very strongly marked and much toothed, median shade distinct, as well as the costal spot which precedes the subterminal line." Staudinger's diagnosis is:—"Paler, with very distinct, serrated, black strigæ" ('Catalog,' p. 82). This therefore is the extreme pale form of the species.

β. var. vallesaica, Sta., = *jotunensis*, Schöyen.—This variety is really marked as in the type, but has the ground colour of var.

ashworthii. It differs from the latter in being without the dark quadrate spot between the stigmata, corresponding with fig. 1 in Newman's 'British Moths,' p. 337. It is figured by Stainton in the 'Annual' for 1855, Plate i, fig. 2, without the black quadrate spot between the stigmata which is characteristic of *ashworthii*. It is undoubtedly synonymous with the var. *jotunensis*, Schöyen. The latter author thus describes his variety:—"Three particularly dark specimens (of *candelarum*) were taken by me from the 2nd to 5th of August, 1885, at Røisheim in Baverdalen, at the northern entrance to Jotunheimen. The size is about that of the Swiss specimens, but the colour is very dark violet-grey, which gives them a very different appearance, and forms a contrast to the light var. *signata*, Stdgr. The species has been found in Sweden, in Oland and Upland" ('Further additions to the Norwegian Lepidoptera,' W. M. Schöyen, Christiania, 1888).

γ. var. *ashworthii*, Doubleday.—The beautiful British variety of *candelarum* was named *ashworthii* by Doubleday. His description is:—"Alis anticis cinereis, strigis tribus denticulatis atris, maculâ quadratâ nigra inter stigmata, posticis fuscis (Exp. alar. 1 unc. 5-8 lin.)." "Anterior wings cinereous, powdered with black atoms, with three denticulated strigæ arising from black spots on the costa; one near the base, a second before, and a third beyond the middle of the wing. Between the stigmata (which are very indistinct) is a quadrate black spot, and another between the anterior stigma and the second striga; a fuscous cloud crosses the centre of the wing as in *Tæniocampa populeti*, *T. instabilis*, etc.; cilia fuscous. Posterior wings fuscous in both sexes with the cilia paler; head whitish; thorax cinereous; abdomen pale fuscous, white towards the base." Mr. Doubleday then goes on to give particulars as to the first capture of this variety. He writes:—"This pretty species, which appears to be quite unknown upon the Continent, was discovered at Llangollen, North Wales, by Mr. Ashworth, in the summer of 1853, and the specimen forwarded to me for inspection. Last summer, many specimens were taken by Messrs. Cooke, Gregson, etc., as noticed in Mr. Stainton's 'Entomologist's Annual,' where the insect is figured under the name of *Spalotis vallesiaca*. The figure, however, is by no means good, the anterior wings being much too broad. I forwarded a specimen of the male and a drawing of the female to my friend, Mr. Guenée, and he says he believes it to be quite new, I have therefore named it after its discoverer. It is closely allied to *A. lucerneæ*, *A. decora*, etc." ('Zoologist,' 1855, p. 4749). Mr. W. Gardner writes ('Entom.,' xxiii, p. 7):—"The indescribably beautiful dove-colour of the fore wings of the perfect insect has already been alluded to. As in so many other living things, this ebbs away sadly with the life of the insect. Across the wings run three wavy dark lines; between the second and third is a rich brown shade, very much enlarged in the female, almost absent in the male; within this patch of colour the orbicular and reniform are more or less conspicuous, according to the intensity of the shade; the hind wings are smoky-grey; and the head, thorax, and body, pale blue-grey like the fore wings. Though simple and quiet in colouring, the imago of *Agrotis ashworthii*, like its larva, is at once beautiful and striking, and cannot possibly be mistaken for any other British species."

δ. var. *virgata*, mihi.—This is an extreme form of var. *ashworthii*, with the central transverse shade extending from the costa to the inner

margin and enclosing the orbicular stigmata. The transverse shade then coalesces with the quadrate spot between the stigmata (characteristic of *ashworthii*) and forms a blackish-brown band extending to the complete basal line. The subterminal line also is generally well developed in the banded form. A good figure of this variety may be found in Newman's 'British Moths,' p. 337, fig. 2.

Agrotis, Och., *lucerneæ*, Linn.

The type of this species is thus described by Linnæus:—" *Noctua spirilinguis lævis, alis cinereis immaculatis: strigis tribus repandis albidis, collari bifido.*" "*Alæ absque macula, complanatæ, fere canæ; collare erectum cordis instar bifidum*" ('Systema Naturæ', Editio x., p. 510). This almost unicolorous whitish-grey form, with no stigmata, and three pale transverse strigæ, is not at all a common form in Britain. Roughly speaking, our specimens are generally either—(1). Dark unicolorous leaden grey = *renigera*, St. (2). Pale grey with a dark central band = *cataleuca*, Bdv. (3). Grey much speckled with ochreous (*renigera*, H. and Wd.). The specimens obtained in the South of England and the Isle of Wight are much paler than those from Aberdeen and other Scotch localities, although naturally, there are intermediate forms where they overlap. The extremes, however, are distinct, the pale typical form, obtained in the Isle of Wight being practically absent in Scotland, whilst the darkest Scotch form (*renigera*, St.) rarely occurs in the Isle of Wight.

a. var. cataleuca, Bdv.—This only differs from the type in having a well-developed dark, central, transverse shade between the positions of the orbicular and reniform stigmata, the latter being almost entirely obsolete.

β. var. renigera, St.—This would appear to be the ordinary dark Scotch form of *lucerneæ* with the ground colour blackish-grey, the transverse lines, median shade and outer margin being still darker. Stephens' description is:—"This species varies from $1\frac{1}{3}$ to $1\frac{1}{2}$ inch in the expanse of the fore wings, which are of a blackish-grey colour, varied more or less distinctly with darker markings and irrorations; the base of the wing is dark, and has a slender pale fascia preceding the very much curved and lunulated pale strigæ, margined with dusky, before the place of the anterior stigma, which is obsolete; the middle of the wing is occupied by a dusky bar, broadest towards the costa and oblique behind, in which appears, but indistinctly, the hinder stigma; then follows a curved row of dark arches pointed outwardly, but often very indistinct, with an irregular rather broad dusky subapical fascia, and a row of indistinct apical brownish lunules. The hind wings with the base paler, and the anal angle greyish. The female is much more strongly marked than the male, and has the cilia of the hind wings pale ochre, whilst in the male it is pale brown. This is a rare but widely dispersed species, occurring in July, in Derbyshire, Westmoreland, and near Forfar" (Humphrey and Westwood's 'British Moths,' p. 126). This is the form known (erroneously of course) on the Continent as *latens*, St., which is undoubtedly referable to *simulans*.

γ. var. renigera, Humph. and Westd.—Humphrey and Westwood copy Stephens' description of *renigera*, but their figures 2 and 3, Plate xxv, exhibit a very different form, the anterior wings being ochreous, the transverse strigæ, median shade, and subterminal shade dark

grey. This ochreous form is not at all uncommon, especially in the more Southern localities in Britain.

Agrotis, Och., *simulans*, Hufn.

Hufnagel's description of the type is a most unsatisfactory one. It is as follows:—" *Phalena simulans*. Der Heuchler. The fore wings of a light greyish-brown colour, with round stigmata and angulated transverse lines." The species is generally known in Britain by the name of *pyrophila*. It is very uncertain in its appearance, but is widely distributed. Its two best known British localities are Portland and Aberdeen. The brown form obtained at Portland is rather more ochreous than the type, but the Aberdeen varieties are very different, and illustrate the tendency of our Scotch specimens to melanochroism. The most extreme varieties I have seen are:—(1). A bright yellow-ochreous form, two specimens of which were captured by Lieut. E. W. Brown, at Portland, in 1890. (2). A black, almost unicolorous form, of which several specimens were taken among other dark blackish forms, by Mr. Reid, of Pitcaple, in 1889 and 1890. This latter form is subject to a great deal of minor variation, but Mr. Reid writes:—"There is no constancy in the variation of the species here (Pitcaple), but there is a great deal of difference in the depth of the ground colour and the distinctness of the markings. I have one specimen, with the stigmata and the three transverse lines across the anterior wings slightly outlined in yellow" (*in litt.*). The Portland form is Hübner's *pyrophila*, which is of "a dark yellowish-brown ground colour, with an abbreviated, followed by a complete double transverse basal line; reniform outlined in pale, a dark transverse line passes between the stigmata from costa to inner margin, a pale double line, edged internally with blackish, just beyond reniform, another pale line, similarly edged with blackish, parallel to hind margin" ('Sammlung europäischer Schmet.', fig. 43). I have seen very few British specimens of the greyish type, although I believe it is occasionally taken. Vieweg's description of the type is almost identical with that of Hufnagel:—" *Noctua simulans* alis deflexis griseo nitidulis strigis undatis nigricantibus" ('Tabellarisches Verzeichniss,' p. 25, No. 31). Taking the greyish-brown form as the type, we get a distinct ochreous form and a distinct blackish form.

a. var. pyrophila, Hb.—Hübner's type of this variety has just been described, and agrees almost exactly with the greater number of specimens captured at Portland. These are of a deep ochreous colour, tending to brown in the darker specimens, with the typical transverse lines well developed. The extreme development of the ochreous colour in the Portland specimens results in the production of a distinctly yellowish form, of which I have only seen Lieut. E. W. Brown's two specimens before referred to.

β. var. suffusa, mihi.—I looked over a large number of picked specimens captured by Mr. W. Reid at Pitcaple in Aberdeenshire, and there was not a single specimen with the greyish tint of the Continental type (*simulans*), nor of the ochreous form of *pyrophila* obtained at Portland. Occasionally a specimen exhibits a very slight ochreous tint in the ground colour, or the same tint about the transverse lines, but most of the Scotch specimens have the fore wings of a dark blackish colour with fairly distinct transverse lines and stigmata, and presenting a very complete melanic tendency when compared with the type or var. *pyrophila*. The hind wings are dark grey.

γ. var. latens, St.—An extreme melanic form of *var. suffusa* occurs sparingly in Scotland. It has the anterior wings, crest and thorax unicolorous blackish, with the space between the stigmata and the internal edge of the transverse lines still more intensely black, otherwise the transverse lines would be lost in the ground colour. I have specimens received from Mr. Reid, captured at Pitcaple, and saw other specimens which had been taken in the Hebrides in 1887. I have no doubt that Stephens' type of *latens* belonged to this species, although Guenée, and, following him, other Continental authors, have erroneously referred it to *lucerneæ*, and at the present time our ordinary dark British *lucerneæ* are sent out as *latens* by Continental dealers. The fact of the presence of a black quadrate spot between the stigmata makes it impossible for the specimen to belong to *lucerneæ*, where the stigmata are practically absent, and the quadrate spot is not developed. In Humphrey and Westwood's 'British Moths' we find:—"The following is Mr. Stephens' description of a single specimen supposed to be this species (*latens*, Hb.), which was taken in the south of Scotland in 1827. 'Resembling the last (*renigera*) in the obscurity of its markings; head, thorax, and abdomen deep cinereous, anterior wings of a glossy ashy-black, most obsoletely strigated transversely with undulated fuscous lines, visible only in certain positions, the first of which is towards the base and abbreviated, the second anterior to the basal stigma, the last beyond the reniform stigma and considerably bent; beyond this the wing is darker, and has, towards the hind margin, an obscure pale denticulated striga, the margin itself immaculate; cilia fuscous; stigmata very obscure, with a dark quadrate spot between them; posterior wings obscure cinereous, with the cilia whitish," (Humphrey and Westwood's 'British Moths,' p. 126). There is no doubt, as I have pointed out above, that this is not a var. of *lucerneæ*, as has been generally supposed. It is not surprising though, that the specimen was not recognised as a var. of *simulans*, as the black forms of this species have only recently become well-known in Britain, and are still practically unknown on the Continent.

Agrotis, Och., *obscura*, Brahm*, Bork.

The type is thus described by Borkhäusen:—"The ground colour dark ashy-grey, shot with faint blood-red on the costa. Two arched indistinct transverse lines divide the wing into three nearly equal parts. The first stands before the usual stigmata, is of a blackish-brown colour, and towards the base is bordered with lighter. The second stands on the other side of the stigmata, and consists of a very faint row of black-brown lunar-shaped spots; it is arch-like in shape, and drawn round the reniform, so that the point where it terminates is just opposite the point on the costa where it commences. Both lines form, at the starting place on the costa, two black points, which therefore produce four dots, and which are again followed, towards the tip, by some grey ones. The discoidal spots are filled in with black. The last (outer) area of the wing is darker than the others, and within it is to be seen a pale zigzag line, and a somewhat paler marking of the wing nervures which cut through this line. The fringes are alternately grey and ash colour" ('Naturgeschichte' &c., iv., 538).

* Brahm has only described the earlier stages. I have therefore taken Borkhäusen's as the type description.

Taking, therefore, the dark ashy-grey form with a red costal area as the type, we have to deal with a few other forms. Sometimes the red overspreads all the surface of the anterior wings, at other times, the wings are dark greyish-fuscous, whilst occasionally, the inner area of the wing is ochreous in colour, the costal area being red as in the type. In all these forms there is some variation in the distinctness of the development of the transverse lines, and in the depth of colour between the stigmata, which is sometimes almost black (= var. *ravida*, Hb.). I have also one unicolorous specimen almost melanic. There appears to be in the arrangement of the colours, a strong superficial resemblance to *A. saucia*. The *ravida* of Treitschke represents the type. He describes it as:—"Alis anticis fuscis, rubro micantibus, characteribus atris; posticis albidis, thorace antice brunneo" ('Die Schmet. von Europa,' vol. v., pt. 1, p. 207). The variation in the stigmata is rather remarkable, more especially the peculiar way in which they are sometimes outlined with black. Guenée writes of this species:—"The specimens from North America are a little duller, especially the inferior wings, and often more unicolorous, but they scarcely merit to be considered a variety" ('Noctuelles,' vol. v., p. 300). A full account of the capture of the type and varieties of this species in Wicken Fen, after a comparative absence in Britain for many years, will be found in the August number of the 'Entomologist's Record,' vol. ii., p. 132. The following is a summary of the varieties we have to deal with:—

- 1.—Costa red, inner margin grey-brown = *obscura*, Bork.
- 1a.—Costa red, inner margin grey-brown, space between reniform and orbicular dark = var. *ravida*, Hb.
- 2.—Grey-brown = var. *obducta*, Esp.
- 3.—Grey-brown, space between reniform and orbicular dark = var. *bigramma*, Esp.
- 4.—Reddish-brown = var. *rufa*.
- 5.—Reddish, space between reniform and orbicular dark = var. *austera*, Esp.
- 6.—Greyish-black, unicolorous = var. *suffusa*.

a. var. *ravida*, Hb.—This is very near to the type, and only differs from it in having the space between the stigmata very dark. It may be described as having the "anterior wings dark grey, with a broad red costa extending from the base to the apex; the transverse lines distinct; the subterminal reddish; the stigmata pale, the space between very dark. Hind wings whitish with dusky nervures" ('Sammlung europäischer Schmet.,' fig. 126).

β. var. *obducta*, Esp.—This is the form in which the whole area of the wing is greyish-brown. Esper's description is as follows:—"Alis deflexis fuscescentibus, stigmatibus, maculis baseos, strigisque duabus posticis repandis pallidis" ('Die Schmet. in Abbildungen' &c., p. 452). The figure (Pl. 142, fig. 4) corresponding with this description has "the anterior wings grey-brown with very pale stigmata and transverse lines, the lower part of the basal area also pale." This totally greyish-brown form, with pale transverse lines, judged from the series I have in my collection, is very much less common than the type, at least in Britain. This is the form described and figured as *ravida* in Newman's 'British Moths,' p. 335.

γ. var. *bigramma*, Esp.—This is closely allied to *obducta*, but has the space between the stigmata blackish and also for some distance inside

the reniform. Esper's description is as follows:—"Alis superioribus cinerascanti-brunneis, stigmatibus ovali et reniformi dimidiato, albidis, interjectis maculis duabus angustioribus nigris, strigis crenatis albidis; inferioribus albis" ('Die Schmet. in Abbildungen' &c., p. 490). Esper's figure (Pl. 150, fig. 2) referring to this description may be described as follows:—"Anterior wings of a dull brown, black between the pale stigmata and also beyond the orbicular; the elbowed line paler." Like *obducta*, this is not at all a common form in Britain. I have seen but very few specimens.

δ. var. *rufa*, mihi.—This is that form of the species in which the whole of the ground colour is of a reddish tint. The transverse lines fuscous and the stigmata pale, usually lined with black at their lower extremities. The subterminal line paler than the ground colour. The hind wings grey as in the other varieties. This is the *ravida* of Hübner, fig. 600 (not fig. 126), which has "the fore wings reddish inclining to reddish-brown, with the costa slightly paler, the transverse lines and stigmata as in the allied varieties. The hind wings pale grey at the base, hind margin darker" ('Sammlung europäischer Schmet.', fig. 600). I have a number of Yorkshire specimens chiefly of this red variety.

ε. var. *austera*, Esp.—This is described by Esper as:—"Alis deflexis fusco-brunneis, macula triangulari nigra, stigmatibus orbiculari et reniformi pallidis insitis" ('Die Schmet. in Abbildungen' &c., p. 452). Esper's Pl. 142, fig. 5, to which this description refers, is of an unicolorous reddish-brown with the stigmata outlined in greyish and with a dark spot between the reniform and orbicular. This unicolorous reddish form is not at all uncommon, although our specimens of this coloration rarely have the dark spot between the stigmata. It is the *crassa* of Haworth, which is described as follows:—"Thorax perfuscus antice rufescens. Alæ basi, lineolâ nigrâ, vel atrâ, aliisque irregularibus inter et circa stigmata ordinaria obsoleta. Stigma tertium imperfectum vel interdum omnino oblitteratum. Sæpe strigæ obsoletissimæ pallidiores ordinariæ plurimarum Noctuarum, fusco plus minus adnatæ, viz., una basi, altera ante, tertia pone stigmata quartaque juxta marginem posticum pallida absque fusco. Alæ posticæ albidæ venis fimbriâque fuliginosis. Exemplaria perpauca solum vidi" ('Lepidoptera Britannica,' p. 220).

ξ. var. *suffusa*, mihi.—This is the darkest variety of the species that I have seen. Anterior wings blackish-fuscous, with a short longitudinal, black streak under base of median nervure; the ordinary transverse lines and stigmata very indistinct and almost unicolorous with the rest of the wing. Hind wings rather darker than in the other forms.

There are also two varieties represented in the British Museum collection not included in the above. These are:—

α. var. *clandestina*, Harr.—Anterior wings obscurely marked, and the costal area greyish and not red as in the type.

β. var. *unicolor*, nom. ?—This is a Canadian form, almost typical, with only the slightest tinge of red on the costal area.

Agrotis, Och., *fennica*, Tausch.

Tauscher, in the 'Memoires de la Société des Naturalistes de Moscou,' vol. i., Plate 13, fig. 4, describes this species as follows:—

"Abdomen griseum ; thorax nigricans ; alæ anticæ nigricanti-fumosæ, strigis ordinariis stigmatæque elongato nigro-fuscis, nævo albido, sæpe fusco-impleto ; macula media in medio lutea, in basi apiceque fusca. Posticæ fuscescentes basi albidæ." " β . Margine postico alarum anticarum læte lutescenti." These are enlarged by Eversmann, who writes:—"Paulo major quam *Agrotis* (*Noctua*) *umbrosa*. Alæ anticæ pro conditione angustiores et longiores, quam in præcedentibus speciebus ; macula media reniformis in medio lutescens, qua facile cognoscitur hæc species ; striga interna et externa dentatæ, vel curvaturis seu semicirculis minutis compositæ, duplices ut in præcedentibus et plurimis sequentibus speciebus, distinctæ, nigro-fuscæ ; spatium submarginale parum distinguitur a colore primario, sed striolis paululum obscuratum est ; margo externus seu spatium terminale pariter non diversum a colore primario, non obscuratum vel fuscum est, ut in præcedentibus speciebus ; stigma plerumque nigro-circumscriptum, interdum autam totum nigrum est." "In varietate β totus margo alarum anticarum posticus sat late lutescit, quo signaturæ evanescent. Hanc varietatem, quæ æquo jure proforma genuina haberi potest, cel. Tauscher descripsit et depinxit" ('Fauna Volgo-Uralensis,' p. 193). Only one specimen has been taken in England, recorded in Stainton's 'Manual,' vol. i., and Newman's 'British Moths,' p. 325, as "captured in Derbyshire."

In the 'Entomologist,' vol. xx., pp. 313-314, Mr. N. F. Dobrée writes:—"As the information in all such works as I have read, whether English or Continental, regarding this rare insect, is very meagre, and the descriptions of it hardly any better, all apparently copied from one another, anything new regarding it will be of interest. I have for years sought for it fruitlessly in St. Petersburg, Finland, and Stockholm, where it is not known to occur, so far as I could learn, and also in the many Continental price-lists that are sent me annually. I have also written for it to dealers in Montreal and Quebec without success, and I failed to find it in the entomological collection sent over for the late Colonial Exhibition in London by the Montreal Society. My friend, the late Mr. George Norman, who, in 1874 and 1875, spent two seasons entomologising in Canada, on the borders of the lakes near Niagara, found it there of excessive rarity. He got but a single one himself at rest on palings in the month of August, and, though the object of his particular research, he could only acquire two more from resident collectors he met. All these specimens are males, and agree well with the drawings in Newman and Herrich-Schäffer. I have now quite lately received it from Western Siberia, and seem at last to have traced it to its home. My correspondent, who I may say in parenthesis, is the curator of a German museum, and an experienced entomologist, after a five years' sojourn in the neighbourhood of Wladiwostock on the Amoor River, chiefly made for entomological purposes, writes to me—"I am not surprised that you are so much struck with the difference between the male and female, but I can fully answer you on that point. The specimens with the broad yellow-ochreish shading on the inner margin of the upper wing are males, the females never have it, at least not in Siberia. I have bred it myself in Nicolajefsk on the Amoor, and was also at first surprised to get two such different imagos from the same larvæ. In 1884, I found about 200 of the larvæ around Nicolajefsk, but

unfortunately all but ten were ichneumonized. The larvæ feed in preference on *Epilobium* and *Corydalis gigantea*, and remain by day hidden in the earth. I have two of these larvæ preserved, of which I hope to send you one. It is an insect which occurs generally here and there throughout Amoorland, and I was fairly successful in my captures of it.

"A point of great interest in this communication is the establishment of a great difference between the male and female. The figures in Newman and Herrich-Schäffer are all of the former; but the latter, the female, seems to have been unknown to any of them. The following is a description of both sexes from the specimens I possess:—
Male—Fore wings warm bistre-brown, with faintly darker transverse lines, the ground colour shading off on the inner margin to a broad band of light ochre; stigmata dirty white. Hind wings and body, of a very pale shade of the fore wings. *Female*—Fore wings quite uniform dark ashy-grey, with faintly darker transverse lines, similar to the male; stigmata dirty white. Hind wings and body, of a very light shade of the upper wings.' It will thus be readily seen that the two sexes might easily be mistaken for quite different species.

"I may further add to the general description that in both sexes the wings are remarkably narrow, and the stigmata exceptionally wide apart; in fact Guenée is quite correct in his remark that the insect has a look quite 'sui generis.' Mr. G. Norman's Canadian specimens, which are all males, quite agree with mine of that sex from Amurland, in size and colouring."

The type is a dark blackish form, whilst Tauscher's var. β has the outer (not inner, as appears from the above to be characteristic of the male) margin yellow. Guenée's *fennica* has the inner margin yellow-ochreous (the male?), whilst Guenée's var. A = Tauscher's type, as it has "the superior wings more slaty, more unicolorous (the female?), with the posterior lines less distinct, the extra basal line more oblique. Stigmata narrower" ('Noctuelles,' vol. v., p. 270).

a. var. *tauscheri*, H.-S.—Herrich-Schäffer describes a variety of *fennica* under the name of *tauscheri*. His description is:—"Violaceo-fusca versus marginem interiorem plus minus ferruginea, stigmatibus ambobus flavido circumscriptis" ('Systematische Bearbeitung' &c.). This is almost Guenée's *fennica*, except that Guenée writes of the latter "inner margin broadly yellow-ochreous" not "more or less ferruginous." This latter form is also the *fennica* of Godart and Duponchel, who figure a form ('Histoire naturelle' &c., plate 90, fig. 10, and p. 533) with the inner margin broadly ochreous. From the quotation recorded by Mr. Dobrée (*vide* p. 84) this may only prove to be the male. The statement is:—"The specimens with the broad yellow-ochreish shading on the inner margin of the upper wing are males, the females never have it, at least not in Siberia."

Agrotis, Och., *hyperborea*, Zett.

It appears to me that the type of this species is Zetterstedt's *alpicola*, but, as the name *hyperborea* is in such general use, I have retained it as the type, and treated *alpicola* as the varietal form. *Hyperborea* is thus described:—"Hadena hyperborea: alis anticis cinereis, parce fuscomaculatis nigroque subirroratis, strigis duabus repandis obscuris externe cano-marginatis, intra quas maculis ordinariis ferrugineo-tinctis positis; posticis cinereo-griseis. ♂ ♀. (Long. al. exp.

$1\frac{1}{8}$ poll.).” He then adds:—“*Noctua hyperborea*. Dalm. in literis. *Hadena*, Boisd. (‘Ind. Lepid.’ p. 71). Hab. in Lapponia. Mus. Reg. Acad. Holm., etiam Schönherri, e quo specimina typica heic descripta mihi benigne communicata (Lappon. borealis). Valde similis *H. alpicola*, sed colore alarum anticarum non tam laete nec pure cinereo, strigis repandis paullo magis conspicuis, maculis ordinariis nonnihil minoribus ferrugineo fuscoque subinctis (nec tantum una macula rubenti, altera s. interiori alba) harum exteriori reniformi, interiori omnino rotunda, nec ovali nec subobliqua, &c. ab illa certe distincta. Antennæ ut in *H. alpicola*, etiam secundum sexum” (‘Insecta Lapponica,’ p. 938). The northern part of the Continent of Europe produces almost entirely ashy specimens, whilst those from the Alps are red or reddish-grey like our Rannoch forms. These red forms are known as *carnica* and *glacialis*, whilst the ashy forms are known as *hyperborea*, *alpicola* and *aquilonaris*. Of a form intermediate between the red and grey forms Dr. Staudinger writes:—“Mr. Janos of Frivaldesky found on the Alps of the Leptauer Comitats, a continuation of the Sudeten Range, a very interesting specimen of *A. hyperborea* which is exactly intermediate between the type and *carnica*, Hering, and unites the two species most certainly, an opinion which I have already expressed in this magazine in 1861, p. 361. Those *hyperborea* found since in the Tyrol and Switzerland, differ very considerably from those found in the north” (‘Stett. ent. Zeit.’ 1869, p. 90). I do not think forms exactly identical with the richly coloured and brightly marked Shetland specimens have been yet taken on the Continent, but Herrich-Schäffer’s fig. 424 is the nearest approach to this form. This species appears to offer an almost parallel range of colour variation to *A. subrosea*, the northern forms of which are ashy-grey in colour, while the British form is of a rich rosy-grey or rosy-brown. It may be looked upon as another illustration of melanochroism accompanying areas of greater humidity and not higher latitudes or colder areas, for while the cold open plains of Finland and Lapland produce pale ashy-coloured specimens, those from the humid districts in Scotland and the Alps develop a depth of colour unknown elsewhere. There is a certain amount of sexual variation, the females being smaller than the males, the abdomina of the females are also very large as in *cinerea*.

The following is a table of the described varieties:—

- 1.—Ashy, with more distinct markings = *hyperborea*, Zett.
- 2.—Ashy, central area reddish-brown = *alpicola*, Zett.
- 3.—Ashy, clouded with reddish, markings obsolete = *aquilonaris*, Zett.
- 4.—Red, with slaty lines = *cærulescens* = *glacialis*, H.-S. (fig. 424).
- 5.—Buff-grey, with cuneiform spots = *alpina*, H. and Wd.
- 6.—Red, with cuneiform spots = *carnica*, Hering.
- 7.—Red, without cuneiform spots = *glacialis*, H.-S.

a. var. alpicola, Zett.—This is also treated as distinct by Zetterstedt, who describes it as:—“Alis anticis laete cineriis, parce fusco-maculatis, maculis ordinariis canis, harum reniformi in medio rubenti; posticis griseis, basi dilutioribus. ♂ ♀. (Long. al. exp. $1\frac{1}{8}$ poll.). Hab. in Lappon. rar.; marem scilicet n monte subalpino Stoettingsfjellet latere Suecico summi jugi alpini d. 31, Jul. 1832 detexit D. Dahlbom, et

feminam in alpe Dowre latere Norvegico ejusdem jugi eodem fere die invenit D. Boheman (Lappon. meridionalis). ♂ ♀. Similiter coloratæ et pictæ. Statura et affinitas *H. dentinæ*, pictura vero alia. Tota cinerea. Palpi testacei. Antennæ in ♂ flavescentes breviter bipectinatae, pectinibus evidenter pennatis versus apicem sensim decrescentibus; in ♀ setaceæ, fuscæ, subnudæ. Alæ anticæ laete cinereæ, maculis subquinis parvis distinctioribus fuscis, quarum 1 ad basin strigiformis 2, 3 et 4 juxta maculam ordinariam anteriorem, et 5 ante marginem posticum in medio, sublunaris. Tota regio macularum ordinariarum præterea fusco-umbrata, rubedine in medio sat perspicua. Ipsæ maculæ ordinariæ albido-canæ, subæqualiter magnæ, anterior rotundata, posterior reniformis. In margine apicali series punctorum minutorum nigrorum. Fimbria cinereo fuscoque varia. Alæ posticæ cinerascentes, basi dilutiores, ciliis albidis" ('Insecta Lapponica', p. 938).

β. var. *aquilonaris*, Zett.—This is described by Zetterstedt as:—"Alis anticis cinerascentibus subbrunnescenti fusco-nebulosis, maculis ordinariis obsoletis, margine summo nigro-punctato; posticis griseo-cinereis immaculatis. ♀. (Long. al. exp. $1\frac{1}{4}$ poll.). Hab. in Lapponia D. Schönherr, e cujus museo mihi missa (Lapponia borealis). *H. hyperboreæ* (No. 6) similis, sed alis anticis præsertim disco magis fusco-ferrugineoque nebulosis, maculis ordinariis, obsoletis-strigis transversis solitariis vix ullis, ut et punctis lunulatis in summo margine postico minutissimis nigris, ab illa dignoscenda" ('Insecta Lapponica,' p. 940).

γ. var. *cærulescens*, mihi = *glacialis*, H.-S. (fig. 424).—This is probably the most beautiful form of the species. The specimens are of a rich red-brown with all the markings of a clear ashy or slaty colour, showing up distinctly the transverse lines and stigmata. The series of cuneiform spots distinct, well-marked in intense blackish, with lineolæ extending from the outer side of reniform. This beautiful variety was bred in some numbers by the professional collectors, Messrs. Salvage, and is to be found in most of our British collections, where it forms a striking contrast to the more unicolorous and duller tinted red varieties obtained at Rannoch, and comprised under the varietal names of *alpina*, *carnica* and *glacialis*. I have called this *cærulescens* from the colour of the pale edging to the transverse lines. Herrich-Schäffer's fig. 424 exhibits this tendency to a great extent, although it is not at all comparable to some of our magnificent specimens. Of this figure the following is a description:—"♂. Anterior wings reddish, with pale grey transverse lines, which have a slight slaty tinge; the commencement of the transverse lines especially pale on the costa, forming short costal streaks; space between the reniform and orbicular filled in with a quadrate black spot, continued beyond orbicular as a small triangular one; two black wedge-shaped spots, pointing in opposite directions directly under orbicular and reniform; two black streaks from the outer edge of reniform cut the pale sub-terminal line" ('Systematische Bearbeitung' &c., fig. 424).

δ. var. *alpina*, Hy. and Wd.—"This new and distinct species measures $1\frac{1}{2}$ -inch in the expanse of the fore wings, which, as well as the body and hind wings, are of a pale buff-coloured grey, the costa of the former marked before and behind the middle, as well as near the tip, with a dusky spot: there is also a patch of this colour near the base towards the posterior margin, and another more elongated extending to the anterior stigma, which is round and grey-coloured, open in

front, and running to the costa; this is succeeded by a small dark patch, and this by the second stigma, which is rather broad and ear-shaped, dusky within, and edged, as well as the other, with brown; from the outer edge of the second stigma extend three dusky rays, separated by the whitish space occupied by the veins of the wing: these rays are cut in the middle by a very much curved series of dusky slender arches, which is followed by a row of triangular dark-coloured patches parallel to the apical margin, which is further marked with minute dusky arched dots; the abdomen and hind wings are of an uniform silky, buffish-grey, with the cilia nearly white" (Humphrey and Westwood's 'British Moths,' p. 118). Our Rannoch specimens are, in their paler forms, reddish-grey with an occasional tendency towards the typical form, but I have never seen anything from Scotland in any way referable to the type. This is perhaps the nearest form. Hering (*vide* under var. *carnica*) speaks of a specimen "with dark yellowish-brown patches." Guenée, however, described a Scotch specimen which he erroneously referred to *carnica*, Hering, as:—"Of a clear ashy colour; the median space darker in all its upper part; the stigmata small, especially the orbicular; the reniform less rounded, and not shaded so distinctly with reddish; the subterminal line very sharp, and black cuneiform spots formed between each nervure" ('Noctuelles,' vol. v., p. 343). Such pale forms are, however, rare in Scotland.

ε. var. *carnica*, Hering.—The original notice of Hering's *carnica* is as follows:—"A. *carnica* (by others called *glacialis* or *egregia*). One of our most active collectors, Mr. Kahr, discovered in 1845 a number of larvæ on the Sanalp near Klagenfurt, which he incidentally saw crawling over the snow. Unfortunately he has not communicated anything as to the habits or other peculiarities of the larvæ. He sent a number of the bred moths though to the Vienna Naturalien Cabinet, and another lot to Berlin. That it is a new species is generally admitted by all lepidopterists. I should, however, not choose the two names *egregia*, Lederer and *glacialis*, Kahr, because they have already been given to other moths. I propose therefore the name of *carnica*, after the locality of this insect. The males and females do not differ materially in colour. The former resemble the colouring of *agathina*, and in the markings, *obelisca*. With both sexes it is a shading of copper-reddish; with the female sometimes mixed with light grey. One of my specimens shows, however, no grey at all, but has patches of a dark yellowish-brown colour. The legs are reddish-yellow, thorax, copper colour, in the female partly mixed with grey; body of male, especially towards the end, reddish. The antennæ of the latter up to the tip, fairly strongly pectinated, in the female plain. The upper margin of primaries is, up to the first strong vein, of the same colour as thorax. Then two arched, notched white lines, divide the wings into three areas, of which the middle one with the stigmata is the largest and darkest, and runs smaller and paler towards the inner margin. The orbicular is mostly covered with white, the reniform red and fringed with white. The orbicular only distinct in few specimens. The 3rd area toward the fringes is much paler, and contains a red-brown notched line, and, with some well marked specimens, are observable small wedge-formed markings, the points of which turn outward. Alongside the last line and fringes are to be seen a row of dark dots. Hind wings are reddish-grey with darker shade towards the lighter fringes" ('Stett. ent. Zeit.,' 1846, p. 236).

Of this variety Staudinger writes :—" var. *incarnata*, non *cærulea*" ('Catalog,' p. 81). He refers Herrich-Schäffer's *glacialis* to this, from which indeed it only differs in the development of the cuneiform spots. This is not at all an uncommon Scotch form.

♂. var. *glacialis*, H.-S.—Herrich-Schäffer's figures may be described as follows:—Fig. 421. " ♂. Anterior wings unicolorous pinky-red, with an abbreviated, followed by a complete basal pale grey line; orbicular but little paler than the ground colour, surrounded with fuscous; reniform of ground colour, its inner lower edge white; space between orbicular and reniform darker; the elbowed line pale grey, formed of lunules; the area beyond the obsolete subterminal line greyer." Fig. 422 = under side of 421. Fig. 423. " ♀. Anterior wings dull greyish-red, with rather darker central area but no quadrate spots; there is a complete row of black cuneiform spots. Hind wings grey, base paler as in fig. 421" ('Systematische Bearbeitung,' figs. 421-423). This red form without cuneiform spots appears to be rarer in Scotland than the corresponding variety in which they are developed. Guenée writes that "this form differs from the preceding (*carnica*, Gn.) in its red colour."

Lycophotia, Hb., *strigula*, Thnb.

The type of this species is described by Thunberg in the 'Museum Naturalium' &c., p. 72, No. 19, where we find :—" *Strigula*. *Cristatalis* deflexis ferrugineis postice albo-striatis, fasciis tribus undatis albis; lineola punctis duobus stigmatibusque albis." He also adds :—" Habitat in Suecica. Missa ex Hollandia, sub nomine *Noctuæ arnicæ* by Osbeck." This species is generally known in Britain by Hübner's name *porphyrea*. The latter name has been used by many European authors, but *strigula* was substituted in Staudinger's 'Catalog,' p. 79. Hübner's *porphyrea* is like Thunberg's *strigula*, a "bright red form with white markings" ('Sammlung europäischer Schmet.,' fig. 93), but his figure 473 is smaller and greyer. Of this species Guenée writes :—" It is truly inconceivable how a species so easily recognised has received so many different names" ('Noctuelles,' vol. v., p. 295). It is the *erice* of Haworth, who calls it a "pulcherrima species" and the *birivia* of Borkhausen, who describes it as "reddish-brown with white markings."

There are besides the bright red type the following forms:—

- 1.—Very pale red, with paler markings = var. *marmorea*, Gras.
- 2.—Small, dark purplish-red, with a slaty tinge = *varia*, Vill. = *concinna*, Esp.
- 3.—Large, basal part reddish-black, outer dark red, pale lines partly suppressed = var. *suffusa*.

a. var. *marmorea*, Gras.—Graslin thus describes the type of this variety :—" Multum similis est *porphyreæ*, sed diversis characteribus differt: colore cinereo-subfusco, linea extrabasilari inferne producta usque ad lineam incurvam; et præcipue antennis, conspicillo spectatis: denticulis valde productis, articulis sursum dilatatis" ('Ann. Soc. Ent. de France,' 1863, p. 312). M. Graslin then compares it with *porphyrea* and writes :—" At first sight it is much less bright in colour than *porphyrea*, not being, like that species, of a porphyry-red colour. The ground colour is greyish-brown with a red tint, and the markings, instead of being in white, are greyish-white. The only parts of the upper wings which have a tint approaching porphyry are the two

longitudinal bands, placed, one under the ordinary stigmata, the other under the claviform, but these are darker than in *porphyrea*, approaching blackish-brown. The orbicular is more oval and the reniform more enlarged at the base." Staudinger says of this variety:—"Dilutior, antenn. paululum differt." "Pyrenees, Jutland" ('Catalog,' p. 79). This pale reddish form is occasionally taken in Britain. I have specimens from the New Forest.

β. var. varia, Vill. = *concinna*, Esp.—This fine purple form I have only obtained from Perth, although I have no doubt it is widely distributed. De Viller's description is:—"Phalæna Noctua varia. Spirilinguis lævis, alis deflexis purpureo, nigro alboque variegatis puncto albo." "Minor. Puncto albo facile dignoscenda, licet laboriosa sit descriptio. Alæ superiores undulatæ, undis albis nigro cinctis vel nigris albo marginatis. Macula reniformis in medio fusca, dein alba, postea in parte anteriore nigro terminata. Macula rotunda sed punctum album annulo nigro circumdatum. Aliquæ maculæ ovales acutissimæ in medio alæ. Subtus omnes griseæ inferiores minus obscuræ" ('Caroli Linnæi' &c., ii., pp. 276, 351). It is the *concinna* of Esper, whose description is:—"Alis superioribus fusco-purpurascentibus, strigis duabus, maculis sparsis, stigmatibusque albis" ('Die Schmet. in Abbildungen' &c., p. 500, Plate 152, fig. 1). It is also the *picta* of Fabricius.

γ. var. suffusa, mihi.—This is a large form, the only specimens I have seen having come from Shetland. The anterior wings dark brownish-red, with the white transverse lines and longitudinal nervures almost of the ground colour in the basal and central areas, the outer part being more typical. Mr. Jenner Weir writes:—"The Shetland specimens are much larger than any I have seen before, and some are distinguished by a total absence of purple on the wings" ('Entomologist,' xiii., p. 289).

Actebia, St., *præcox*, L. (?), Esp.

This is a most invariable species. There appears to be no marked variation in the markings, and the colour is generally very constant, although occasionally specimens are found of a bluish-green, instead of the normal green coloration. The Linnæan description is as follows:—"Noctua spirilinguis cristata, alis deflexis cinereis bimaculatis postice rufo-subfasciatis" ('Systema Naturæ,' x., p. 517). The reddish fascia on the hind margin is characteristic, but it appears strange that there is no mention of the typical green coloration in the description. Of this Guenée writes:—"To recognise this from the Linnæan description, one must suppose that he made his description from a faded specimen, and to remember that in certain editions of the 'Systema Naturæ' he uses the terms 'posterioribus fascia rufa,' 'postice rufo-subfasciatis,' which apply to the superior wings." Guenée also adds:—"It varies but little. Engramelle's fig. 466, and a specimen which I have seen in the collection of M. Pierret have the superior wings bluish-green instead of glaucous-green" ('Noctuelles,' vol. v., pp. 296-297).

α. var. præceps, Hb.—The bluish-green variety is called *præceps* by Hübner. His figure may be described as follows:—"Anterior wings of a bright bluish-green with a white patch at the bottom of the basal area; two double transverse basal lines; claviform pale, orbicular outlined in whitish, reniform white, a dark green shade between the

orbicular and reniform ; the black elbowed line is followed by a broad red fascia reaching from inner margin almost to costa. Hind wings dark grey with pale hind margin and distinct lunule" ('Sammlung europäischer Schmet.,' fig. 70). I have already referred to Guenée's remarks on this variety. I have a specimen of this form bred from a larva taken at Hunstanton.

Triphaena, Och.

Of the British species in this compact little genus, three, *janthina*, *interjecta* and *subsequa*, are comparatively constant in their colour and markings, whilst the remaining three, *fimbria*, *pronuba*, and *orbona*, on the other hand, vary in both directions to a remarkable degree. The Scotch specimens of *orbona* have attracted a great deal of attention to this species, and one has to search among the more variable members of *Agrotis* or *Apamea* to find an equal range of colour variation. There is no doubt that the nomenclature at present in use, viz. *orbona*, Hufn. and *comes*, Hb., will have to be respectively changed to *subsequa*, S.V., Hb. and *orbona*, Hufn.

Triphaena, Och., *interjecta*, Hb.

This is another comparatively constant species, although some specimens are of a brighter reddish than others. Hübner's type may be described as :—"Fore wings of a very dull reddish-brown colour (almost greyish), the black marks on the hind wings being very strongly developed" ('Sammlung europäischer Schmet.,' fig. 107). Newman writes of it : "The colour of the fore wings is rusty-brown, sometimes inclining to brick-dust-red, and having a broad but imperfectly defined band of smoky-brown on the hind margin" ('British Moths,' p. 340). There is a large amount of variation in the development of the transverse lines, both in the type and the var. Taking the dull brownish form as the type, there is only the bright red form that can be looked upon as a variety.

a. var. rufa, mihi.—The anterior wings with the ground colour bright red, the stigmata and transverse lines being marked as in the type ; the hind wings also as in the type. The bright red form appears to be more common than the duller brown form in Britain, although neither are at all rare.

Triphaena, Och., *janthina*, Esp.

This species varies but little in any direction. There are two distinct forms in colour, one, purplish, the other, red-brown, otherwise there appears to be no variation worth noticing. Newman writes :—"The colour of the fore wings is remarkably rich and attractive, and is less liable to vary than in any other species of *Tryphaena*" ('British Moths,' p. 338). The purple form is Esper's type. Of the latter I made the following description :—"♂. Anterior wings purplish-grey, with the orbicular and reniform (8-shaped) dark reddish in colour, outlined in yellowish, a transverse, angulated line just beyond the reniform, the space between this and the base tinted with green, except a broad costal area which is purplish-red ; a dull red patch on costa near apex, and a red subterminal line. Hind wings yellow (paler than is usual with our British specimens), base dark grey ; broad, black hind margin ; the nervures pale in the black band, dark in the yellow part of the wing." "The ♀ is almost as the ♂, but the red apical patch is replaced by greenish-grey. Hind wings orange, basal patch and

outer margin black" ('Die Schmet. in Abbildungen' &c., Pl. 104, figs. 4-5). His diagnosis on p. 150 of the same work is:—"Noctua spirilinguis subcristata alis incumbentibus superioribus fuscis viridi et violaceo nebulosis, posticis luteis limbo basique nigro." Green is a very unusual tint in British specimens of this species. Mr. Gregson writes:—"The only variety I have seen of this species was bred last year, from a larva taken near Conway: the ordinary orange of the hind-wings is straw-coloured" ('Entom.,' iv., p. 53).

a. var. rufa, mihi.—This differs from the type in having the purplish-red ground colour of the anterior wings replaced by bright red. It is otherwise like the type in markings &c., and is in fact a simple colour variety, occurring apparently, in most localities with the type. Intermediate forms between this and the type are not at all rare.

Triphæna, Och., *fimbria*, L.

This species, probably one of the richest coloured and most attractive moths we have, is subject to a very considerable range of colour variation. This variation runs in two parallel grooves, one, from the palest wainscot-brown, or pale yellowish, through bright red-brown to deep mahogany-brown, the other, from pale greyish-green to a deep, dark green, generally, however, with slight traces of brown in it. The Linnean description of the type is as follows:—"Noctua spirilinguis lævis alis incumbentibus griseo fasciatis; inferioribus helvolis macula lineari atra." "Simillima pronubæ. Corpus incarnatogriseum. Thorax vix cristatus. Abdomen helvolam subtus albicans. Alæ supra superiores fasciis liturisque obscurioribus inæqualibus. Inferiores helvolæ macula longitudinali nigricante apicibusque albicantibus. Subtus superiores helvolæ macula longitudinali nigricante, apiceque albicante. Inferiores concolores paginæ superiori, apici albidæ" ('Systema Naturæ' xii., 842). Newman says of the variation in this species:—"The colour of the fore wings is pale wainscot-brown, or rich mahogany-brown, or rich olive-green; the specimens of the mahogany-brown colour are comparatively rare, those with the wainscot-brown and olive-green colour are equally common" ('British Moths,' p. 339). Guenée writes:—"I consider as the type, those specimens in which the thorax and wings are of a clear pale nankin colour, with a median band and other markings of a deeper brown, the two black apical spots scarcely visible, sometimes altogether absent. Hübner has not figured the form" ('Noctuelles,' vol. v., p. 318). The following is a list of the principal varieties:—

- 1.—Pale yellowish-grey = *fimbria*, L.
- 2.—Reddish-ochreous (almost red-brown) = *var. rufa*.
- 3.—Mahogany-brown = *var. brunnea*.
- 4.—Pale greenish = *var. virescens*.
- 5.—Dark green = *solani*, Fab.

a. var. rufa, mihi.—The anterior wings of this variety differ from those of the type in being of a rich reddish-ochreous, extending into red-brown. The stigmata are generally as distinct and the transverse lines as well-marked as in the type. I took about a dozen specimens on the Deal sand-hills in 1885, all of this form. I have the variety, however, from other localities, and there is no doubt that it occurs generally with the type. This is Guenée's *var. B*, of which he writes:—"The green of *var. solani* is replaced by a clear brick-red; it is not only this species that is thus modified, as we find the

same modification in *Smerinthus tilæ*, *Phlogophora meticulosa*, *Ennomos fasciaria*, etc." ('Noctuelles,' vol. v., p. 318).

β . var. *brunnea*, mihi.—This is Hübner's fig. 551, which is of a dark mahogany-brown colour, and which he calls by the type name *fimbria*. The transverse lines and stigmata are generally remarkably well marked. It is an extreme development of var. *rufa*, and comprises the darkest of the brown forms. I have specimens from many different localities. A sub-var. (*brunnea-virescens*) occurs, intermediate between vars. *brunnea* and *virescens*, of a dark red brown colour tinted with green. This is Hübner's fig. 532, which is a very dark brownish-green form.

γ . var. *virescens*, mihi.—This is Hübner's fig. 102, which has the anterior wings of a very pale greyish-green with a pinkish tinge. The variety is not at all uncommon and seems almost as widely distributed as the type.

δ . var. *solani*, Fab.—The Fabrician description of this green variety of *fimbria* is as follows:—"Noctua cristata, alis incumbentibus virescenti griseoque variis; posticis rufis, fascia lata submarginali." "Nimis *N. pronubæ* affinis, differt tamen alis anticis magis virescentibus. Versus apicem puncta aliquot alba ad marginem crassiorem et juxta hæc macula parva atra. Posticæ rufæ fascia lata atra. Subtus omnes multo dilutiores" ('Mantissa,' p. 150). Guenée writes of *solani*:—"The bands are more marked, green; they extend almost to the base of the wing, the costa excepted; the thorax is also green; the stigmata are surrounded with clear yellowish, and the black apical spots are very distinct" ('Noctuelles,' vol. v., p. 318).

Triphæna, Och., *subsequa*, S. V., Hb.

This species known so long in Britain under the above name, is most constant in its coloration and markings. Until it occurred somewhat freely at Forres, it was a rare British insect, but has now not only been captured in some numbers, but has been bred rather freely. It is superficially very much like *orbona*, Hufn. = *comes*, Hb. but the presence of the black costal spot near the apex is a fixed character so far as we at present know. Strange to say, Hufnagel's original description of *orbona*, to which this species has been referred, has no mention of this characteristic spot, and Dr. Staudinger seems to have been guided by Rottemburg's later description under the name of *orbona*, in thus incorrectly changing the nomenclature in his 'Catalog.' The *subsequa* of Hübner is identical with *subsequa*, S. V., and his fig. 106 may be described as follows:—"The anterior wings of a dull reddish-brown with four transverse lines, each with a small black dash at the upper end. The dashes (of which that at the apex of the subterminal is strongest) are on the side of the line nearest the stigmata" ('Sammlung europäischer Schmet.,' fig. 106).

I have so far seen nothing worth calling a variety, although there is a little variation in depth of ground colour, and some specimens show a tendency to reddish.

Triphæna, Och., *orbona*, Hufn.

There is no doubt that *orbona*, Hufn. is the type of this species, and that Staudinger is wrong in treating *orbona*, Hufn. as synonymous with *subsequa*, S. V., Hb. *Consequa*, Hb., referred incorrectly by Staudinger to *subsequa*, also represents this species. It (*consequa*) is referred by both Guenée and Dr. Staudinger as a var. of *subsequa*,

but they are most certainly in error. The species varies excessively, from pale whitish-grey to intense black, with beautiful vinous-red, and brown intermediate forms. The hind wings, too, vary from white and the palest yellow, to black with no trace of yellow in them. The varieties in England appear to follow those in Central and Southern Europe and are restricted to very narrow limits. The Scotch specimens are the most variable, and the perfectly melanic condition of some specimens is very remarkable. Some of these Scotch varieties were figured in the 'Entom.,' vol. xxii., belonging to Mr. Clark, who wrote of them as follows:—"In the autumn of last year I obtained a series of the variable Forres form of this species, together with a number of ova. These hatched, and I reared the larvæ through the late autumn on dock leaves (*Rumex pratensis*) in a warm room, thereby avoiding the large percentage of loss which usually occurs when it is attempted to hibernate them. On December 3rd, the first of the specimens appeared, and the bulk of the remainder by the 15th, a few stragglers lagging behind till the last week in January. The result was a fine series, consisting of thirty-six specimens, the whole of which were totally different from our usual southern forms, and, *inter se*, they presented a very considerable difference, both in shade and markings, as will be seen from the accompanying plate.

"The series may be divided into four main groups, and a fifth, containing varieties which can hardly be collated with any of the other forms. They are as follows:—

"GROUP A.—The pallid or clay-coloured form, which more nearly resembles the typical South of England form than any other. This is illustrated by two examples. Fig. A, 1, where we have the markings similar to the usual South of England type, but the coloration intensified. Fig. A, 2, like fig. 1, but the fore wings much suffused with reddish colour, and the lunules on the fore wings rufous. GROUP B.—Fig. B, 1. Fore wings rufous, with but indistinct markings; the submarginal line is almost absent. Fig. B, 2. A more intensified form of fig. 1, with the subterminal line very distinctly marked. Fig. B, 3. This is a beautiful variety, the fore wings having a rich, almost crimson, shade suffused over them; the stigmata are darker, and delicately edged with a golden line; on the costa is a dark spot, which at the first glance gives the insect the appearance of a rufous type of *Triphæna orbona*, Hufn., = *subsequa*, Hb.* Closer inspection, however, proves that it is a true *T. comes*. GROUP C.—Var. *curtisii*. This is a richly-coloured series, quite distinct from either of the foregoing, the colours indeed reminding one rather of *Triphæna interjecta*, Hb., than the ordinary *comes*. Fig. c, 1. The colours of the fore wings of this variety are a rich claret-red, with no dark markings, even the stigmata being only indicated by outlines of golden yellow; the hind wings are quite smoky throughout, and the black border very broad. Fig. c, 2. This is a still darker form, the fore wings being a rich ruddy umber, almost black, on the hind and inner margins, and the discoidal spots are clearly defined by fine golden outlines. GROUP D.—Fig. D, 1. In this variety the general tone of the fore wings is as intense as that of c, 2, but the claret colour

* This synonymy is wrong. *Orbona*, Hufn. = *comes*, Hb. not *subsequa*, Hb. as recorded in Staudinger's 'Catalog.'

is giving place to a dark slate; the pale line beyond the discoidal spots is very distinct. Fig. D, 2. Here we have the clay colour of the first set, the rusty line of the second, and the rich claret-red of the third series entirely replaced by a dark slate or smoke colour, with hardly any markings at all.

"Of the unclassified series, Fig. E is the most singular; it is a very rich blue-slate colour, suffused with red on the costa, all the markings, except the inner lines, being very distinctly picked out. Its great features, however, are to be found in the hind wings: the right wing is like D, 2, with the usual lunule; but the left is very much paler, and has no lunule spot at all. Fig. F. In this variety, the base of the fore wings is pale, the centre is dark like D, 2, and the tip and costa paler, with the terminal bands very distinctly defined; the hind wings are a greyish-yellow, the left being lighter than the right; the band is paler and of a smoky-black. Fig. G. This can hardly be referred to any of the other groups, though it more nearly resembles a redder form of fig. 2; the subterminal line is very dark and distinct, while the inner lines, too, are very clearly defined; the whole fore-wing, indeed, is richly mottled with delicate lines and patches of colour; the hind wings are somewhat like the last variety, but rather brighter. Of the series of 36, which were reared from this brood of ova, 8 belonged to group A, 14 to group B, 14 to group C, and none to D. Those of group D, and the unclassified series were captured. The intensity of the colouring of group B, and more especially of group C, cannot adequately be shown by any lithograph, as there is a warmth and depth of colouring, giving them a wonderful richness, which is lost in the printing.

"It is singular that while *Triphaena comes* should present such remarkable varieties,—such, indeed as would warrant their being called new species, could their various gradations be not traced southwards to the locality of the typical *comes*,—yet *Triphaena fimbria* and *T. interjecta*, bred from the same locality, present no difference in form to the southern types" ('Entomologist,' xxii., pp. 145-147).

Some of the varieties figured by Mr. Clark, 'Entom.,' xxii., Pl. vi., are very peculiar, especially those marked E and F, where the coloration of the left hind wing in each, is very striking and unusual, fig. E, not only being different in colour, but without a lunule. More melanic forms than figs. D, 1 and D, 2 are known, some having the hind wings almost as black as the fore wings.

The type of this species is thus described by Hufnagel:—"Fore wings reddish-brown, reniform stigma brown. Hind wings orange colour, with a black margin and black lunule" ('Berlin Magazin,' iii., 304). There is no trace here of any mention of the characteristic black costal streak of *subsequa*, and there can be no doubt the description refers to the *comes* and not the *subsequa* of Hübner. Of *comes*, *adsequa* and *prosequa*, Treitschke writes:—"I must, however, emphatically affirm that I have the most gradual transitory forms before me, and that I have bred the var. *prosequa* from the larva of *comes* as figured by Hübner" ('Die Schmet.' etc., vol. v., p. 256). The *comes* of Hübner is identical with *orbona*, Hufn., being of the same red-brown colour. So also is the *subsequa* of Esper, which is thus described:—"Noctua spirilinguis lævis alis incumbantibus fuscis, punctis saturatioribus, stigmatibus ordinariis; inferioribus luteis, fascia marginali,

punctoque in medio atris.”—The figure to which this description refers may be described as:—“Anterior wings pale reddish-grey with dotted basal line; dark stigmata outlined in paler, but no claviform; two dotted lines occupy the places of the ordinary elbowed and subterminal, the latter edged on both sides with darker” (‘Die Schmet. in Abbildungen,’ p. 149, pl. 104).

1.—Pale grey = var. *adsequa*, Tr.

1a.—Pale grey, tinted with red = var. *pallida*.

2.—Dark stone-grey = var. *grisea*.

2a.—Dark grey, tinted with red = sub-var. *rufo-grisea*.

3.—Dark blackish-grey = var. *consequa*, Hb.

4.—Pale ochreous = var. *ochrea*.

4a.—Pale ochreous, tinted with red = sub-var. *rufo-ochrea*.

4b.—Pale ochreous, tinted with green = sub-var. *virescens*.

5.—Pale red = var. *rufescens*.

5a.—Bright dark red = var. *rufa*.

5b.—Reddish-brown = var. *orbona*, Hufn.

6.—Brown, with red costa = var. *curtisii*, Newm.

7.—Black = var. *nigrescens*.

7a.—Black, with red costa = sub-var. *rufo-nigrescens*.

The following varieties have also been described:—

1.—Without lunules on hind wings = var. *connuba*, Hb.

2.—With narrow border to hind wings = var. *subsequa*, Haw.

3.—With contiguous stigmata = *subsequa*, Curt.

4.—Reddish-brown, variegated with darker = *prosequa*, Tr.

a. var. adsequa, Tr.—Of this variety Dr. Staudinger writes:—“Pallidior, unicolor; vix mom. conserv.” (‘Catalog’, p. 81). Treitschke himself writes:—“Light greyish, without any distinct markings” (‘Die Schmet.’ &c., vol. v., p. 256). This pale form is one of the commoner forms in Britain, I have it from many localities north and south. Guenée treats it as the same as *consequa*, Hb., but, since *adsequa*, Tr. is light grey, and *consequa* is dark grey in colour, he is evidently in error.

β. var. pallida, mihi.—Anterior wings of a pale grey colour tinted with reddish, the stigmata and transverse lines rather variable in intensity and development. The form is not uncommon both in northern and southern localities in Britain, although perhaps it is rather more common in England than Scotland. This is simply a sub-variety of *adsequa*, Tr. It is figured ‘Entom.,’ xxii., Pl. vi., figs. A, 1 and A, 2, the red in these being rather strongly marked.

γ. var. grisea, mihi.—This dark grey form is by far the commonest variety found in the southern counties of England. It is also widely distributed among the rarer Scotch varieties. Sub-var. *rufo-grisea*, is closely allied to *grisea*, but has the grey ground colour lightly tinted with reddish. It is also rather a common form.

δ. var. consequa, Hb.—This is treated as a var. of our *subsequa* by Staudinger and Guenée, but there is no doubt that it is a var. of *orbona* (*comes*). A note I made in 1887 is as follows:—“The anterior wings are of a dull purplish-brown with pale bluish-grey transverse lines (‘Sammlung europäischer Schmet.,’ fig. 105). It is undoubtedly a form of *orbona* (*comes*), and as such takes priority of the latter name (*comes*), even if *comes* were, as is sometimes assumed, the type.

Guenée lays much stress on the marked costa, but Hübner's figure certainly does not show our characteristic, short, black streak." Guenée writes of it:—"Of a greyish-black, with the white spot which follows the elbowed line very marked on the costa, forming a clear descending band. The two apical marks lost in a large blackish costal blotch. Inferior wings with the border and the lunule larger." "Southern Russia" ('Noctuelles,' vol. v., p. 319). Staudinger says of it:—"obscurior et punctis nigr. distinctis" ('Catalog,' p. 81). Mr. Adkin has apparently come to the same conclusion that I long ago arrived at, for we read:—"Hübner's *consequa* should be regarded as a form of *comes*, Hb., rather than *orbona*,* Hufn., to which it had hitherto been referred, and supported his contention by specimens known to be forms of *comes*, Hb., which agreed with Hübner's figure of *consequa*" ('Entom.,' vol. xxiv., p. 102). This is a not uncommon form in Scotland, and occasionally occurs in England, being the darkest form we obtain in the southern counties.

ε. var. *ochrea*, mihi.—The anterior wings of a pale greyish-ochreous tint, with the markings and stigmata varying slightly in intensity. But for the ground colour, the form is a great deal like var. *adsequa*. Sub-var. *rufo-ochrea* has the ochreous ground colour tinted with reddish. This is really a more usual form than var. *ochrea* itself. It appears to occur in most English and Scotch localities. Another sub-var. has the ochreous ground colour tinted with green=*virescens*, but the green tint is very evanescent.

ξ. var. *rufescens*, mihi.—This has the anterior wings unicolorous pale red, with the stigmata and markings generally well developed. It is a fairly common form in Britain, in both northern and southern localities. It is figured 'Entom.,' xxii., pl. vi., fig. B, 1, but the colour here is rather too marked.

η. var. *rufa*, mihi.—An extreme development of *rufescens*, with the anterior wings of a deep, but bright red colour, the posterior wings in Scotch specimens often being much darker than those found in England, although the form is obtained throughout Britain. It is, however, very rare in the south of England. This variety is figured 'Entom.,' xxii., pl. vi., figs. B, 2 and B, 3. The description—Group B, p. 145—shows that these figs. are not so good as they might be.

θ. var. *curtisii*, Newm. = var. *consequa*, Curt.—The name *curtisii* has recently been applied to almost all Scotch specimens of *orbona* varying from pale grey to intense black. As it was originally meant to apply only to the very dark brown form with a distinct red costa, it is advisable to retain the name for that form. In the 'Entomologist,' vol. v., pp. 224-225, Mr. Newman writes:—"The perfect insect is admirably figured in Curtis' beautiful 'British Entomology,' fasc. 348, dated 1st March, 1831, under the name of *Tryphæna consequa* or Bute Yellow Underwing, but, as it certainly is not the *Noctua consequa* of Hübner, I at once suggested that it should receive the name of the talented artist who described it, and who has figured it so beautifully. Mr. Curtis possessed but a single specimen, taken by himself on the heath at the back of Mr. Kean's house, in the Isle of Bute, on the 27th of July, 1825. Mr. Norman has taken it more abundantly during the past summer, near his residence at Forres. Mr. Curtis

* Used erroneously for *subsequa*, Hb., as in Staudinger and Wocke's 'Catalog.'

describes it in these words:—"Brown, palpi reddish, crown of the head pale; superior wings comparatively short, narrow at the base, and considerably broader at the apex, with the costa reddish; two pale strigæ towards the base, an oblique, oval, and an auriculate stigma, with pale margins and reddish centres towards the middle, beyond which are two pale sinuated strigæ, the nervures between them pale, and bearing a row of dots as well as the posterior margin: inferior wings orange, fuscous at the base, the nervures fuscous, a black fimbria, narrow at the anal angle, curved above and reaching the centre where it forms a crescent, the extreme edge indented and not touching the margin; abdomen cinereous; the sides and apex ferruginous" (Curtis, *l. c.*). Mr. Curtis, well aware of the similarity of this species to the familiar *Tryphæna orbona*, thus differentiates them:—"That my specimen is distinct from our other species there is no doubt, for the superior wings are formed more like those of *Cerigo texta*, the stigmata are larger than in *T. orbona*, the fascia of the inferior wings is broader, and the superior margin beneath is black and not rosy; in colour, it most resembles the *N. conseqa* of Hübner ('Noct. tab.,' 23, fig. 105); his *N. subsequa* is more like *N. orbona*."

"In the 'Insect Hunter's Year-book' for 1870, I have taken considerable pains to differentiate this species from *Tryphæna orbona*, with which it may very excusably be confounded by those who do not possess a series of both. There are now in the possession of myself and others a great number of chrysalides, and, when they emerge, some of them will infallibly reveal their ancestry if they be really the descendants of *Tryphæna orbona*. I notice that the very variability of these two species has been urged as a plea for reuniting them as a single species; but this appears to me quite as cogent a reason for keeping them separate, since I have often observed that two cognate species may, and frequently do, exhibit an infinity of variations."

This variety is also figured 'Entom.,' xxii., pl. vi., figs. c, 1 and c, 2. A very large number have been distributed in late years by Mr. Reid of Pitcaple and the Aberdeen collectors.

ι. var. *nigrescens*, mihi.—The anterior wings black, the stigmata and transverse lines, which are generally dark in those varieties which have a pale ground colour, being of a very pale shade, making these show up rather conspicuously against the dark ground colour. The hind wings are also frequently much suffused with dark scales. I only know the variety from Scotch specimens. Sub-var. *rufo-nigrescens* is a form of the above with a distinct red costa, as in the allied var. *curtisii*. Var. *nigrescens* is figured 'Entom.,' vol. xxii., pl. vi., fig. d, 2, and *rufo-nigrescens*, fig. d, 1, although the red costa in the latter should be much more distinctly marked.

κ. var. *nigra*, mihi.—This is the most extreme melanic form of the species, in which the posterior and anterior wings are almost uniformly black. I have seen such forms from Scotland only.

The following varieties are closely allied to some of the classified forms:—

α. var. *connuba*, Hb.—This is the variety of *orbona* in which there is no trace of the characteristic lunule on the hind wing. Hübner's figures may be described as:—"Anterior wings pale orange-brown with paler (yellowish) transverse lines and pale nervures; the orbicular and reniform outlined in yellow. The posterior wings as in *orbona*, but without the lunule" ('Sammlung europäischer Schmet.,'

figs. 680-681). Dr. Staudinger gives it, with doubt, as belonging to *pronuba* var. *innuba*, and remarks:—"Ab. pallida, an *comes* ab. (?) " ('Catalog,' p. 81). The absence of the lunule seems to have misled him into placing it with *pronuba*. Guenée writes of it:—"I have not seen it in nature, and I do not know whether or not it forms a distinct species. After the figure of Hübner, the wings are more elongate in shape, the cellular lunule of the hind wings is entirely absent; the superior wings are of a yellow-ochreous tint, with the markings clear, and the terminal outer margin darker " ('Noctuelles,' vol. v., p. 320). Treitschke writes of this variety:—"Of *connuba*, Hb., I dare not pronounce a decided judgment, as I have not found them in nature, yet I think that it might be a var. allied to *adsequa* " ('Die Schmet.' &c., vol. v., p. 256). I have specimens without the lunule on the hind wings from Deal and other localities. Mr. Gregson writes:—"Of this species I have two specimens without the central lunule on the under wings, the colour of the under wings of one of them being light yellow, both are bred specimens " ('Entomologist,' vol. iv., p. 53).

β. var. subsequa, Haw.—This is a sub-variety of *prosequa*, Tr., in which the black border to the hind wings is very narrow. Haworth writes of it:—"N. alis hepatico-fuscis punctato strigatis; posticis perluteis, lunulâ centrali fasciâque posticâ nigris." "Præcedenti (*orbona*, Haw.) forte varietas, differt vix, nisi in fasciâ posticarum alarum nigrâ parum angustiore, et minus terminali quam in illâ " ('Lepidoptera Britannica,' p. 161).

γ. var. subsequa, Curt.—Guenée writes of this variety:—"Of a burnt-brown colour, with the stigmata contiguous and the nervures paler " ('Noctuelles,' vol. v., p. 320). This, like *prosequa*, Tr., is also a sub-variety of the type, having the same reddish-brown colour, but with united stigmata.

δ. var. prosequa, Tr.—Guenée writes:—"This is the opposite to *connuba*, Hb., the designs being strongly marked, the ground colour of the wings dark brown, with the pale scales which border the transverse lines very apparent " ('Noctuelles,' vol. v., p. 320). Dr. Staudinger writes of it:—"Obscurior, distinctius variegata " ('Catalog,' p. 81). Treitschke writes of it:—"Red-brown, marked more distinctly with dark brown, sprinkled with white (= *prosequa*, Och.) " ('Die Schmet.' &c., vol. v., p. 256). This is closely allied to Hufnagel's type, but is more variegated with darker markings.

ε. var. virgata, mihi.—This form has the anterior wings of a reddish-brown colour like the type, but with the transverse shade, which is sometimes slightly developed in other varieties, formed into a distinct dark central band. A specimen resembling in some degree this form, is figured 'Entom.,' xxii., pl. vi., fig. g.

Triphaena, Och., *pronuba*, L.

The Linnæan description of this common and variable species is as follows:—"Noctua spirilinguis cristata, alis incumbentibus griseis; inferioribus luteis, fascia atra submarginali " ('Systema Naturæ,' 10th Edition, p. 512). The best example of this unicolorous grey type that I have seen was captured in Wicken, but the form appears to be rare. The variation in the colour of this species is only a little less than that in *orbona*. This species is not only very variable in ground colour but also in the development of the markings. The former varies from pale greyish-ochreous to deep blackish-brown, the latter from almost

total absence to well-developed, strongly marked, transverse lines and stigmata. Newman says of the variation in this species :—" In different specimens, the fore wings vary in general colour, from pale wainscot-brown to rich umber-brown, and occur with almost every intermediate shade ; the discoidal spots are generally clearly defined, the circum-scription being paler than the ground colour ; in some specimens, the orbicular is entirely pale ; there are many transverse lines, some darker and some paler, but these are very variable and inconstant ; there is, however, a pale line parallel with the hind margin almost invariably present, and adjoining the upper or costal extremity of this is a double black spot. The hind wings are orange-yellow without a discoidal spot, but having a narrow waved black band parallel to the hind margin ; the head and thorax are of the same colour as the fore wings, the body paler and inclining to reddish-yellow towards the tip : on the last segment but one is a transverse black spot. In a beautiful variety, in which the fore wings are much variegated, the head and collar are pale brown" (' British Moths,' p. 342). In this species the variation is of a distinctly Agrotid character. There are two forms, one, almost unicolorous, the other, with a pale costa, a dark quadrate spot between the reniform and orbicular stigmata, extending as a wedge-shaped mark beyond the orbicular, inner part of reniform dark, and dark marbling under these stigmata. This is only clearly seen in the darker forms, where the costa and transverse lines retain the ground colour and stand out distinctly from the darker shading surrounding these paler markings. These paler areas and markings (costa, &c.) are generally grey or ochreous, sometimes standing out conspicuously, at other times gradually blending with the darker areas, and hence approach the intermediate forms.

The following is an attempt to classify the various forms :—

- 1.—Pale greyish, almost unicolorous = *pronuba*, Linn.
- 2.—Greyish-ochreous, almost unicolorous = var. *ochrea*.
- 3.—Reddish-ochreous, almost unicolorous = var. *rufa*.
- 4.—Red-brown, almost unicolorous = var. *brunnea*.
- 4a.—Red-brown, with ochreous costa, dark space between stigmata, &c. = sub-var. *ochrea-brunnea*.
- 4b.—Red-brown, with greyish costa, dark space between stigmata, &c. = sub-var. *grisea-brunnea*.
- 5.—Black-brown, almost unicolorous = var. *innuba*, Tr.
- 5a.—Black-brown, with ochreous costa, dark space between stigmata, &c. = sub-var. *ochrea-innuba*.
- 5b.—Black-brown, with greyish costa, dark space between stigmata, &c. = sub-var. *grisea-innuba*.
- 6.—Slaty-grey, almost unicolorous = var. *cærulescens*.
- 6a.—Slaty-grey, with dark reniform, dark space between stigmata, &c. = sub-var. *distincta-cærulescens*.
- 7.—With a black lunule on hind wings = var. *hoegei*, H.-S.

The variety *hoegei* of Herrich-Schäffer is peculiar in having a black lunular spot on the hind wing. This is rare, and shows a tendency in this species to produce what is normal in another closely allied one (*orbona*) ; the opposite condition is also occasionally found, *i.e.* *orbona* in its var. *connuba* follows typical *pronuba* in having no such lunule. Guenée writes :—" *Innuba*, Tr., which German authors have for a long time considered to have a distinct larva, divides itself between

these two races (vars. *ochrea* and *innuba*). Its characters according to Treitschke would be:—"The costa and the collar concolorous, the extra basal lines less arched, the nervures less apparent at their extremities, the stigmata less distinct, the reniform smaller" ('Noctuelles,' v., p. 321). Guenée then adds:—"Some of these characters are purely imaginary," and there is no doubt, if they are not imaginary, they are too inconstant to be of use in classification.

a. var. ochrea, mihi.—This greyish-ochreous, almost unicolorous form is much commoner than the grey type. The anterior wings have no dark markings except the short black costal streak near the apex and the inner part of the reniform. The orbicular is sometimes rather paler than the ground colour, but, like the transverse lines, more often unicolorous. I have specimens from several localities. This is Guenée's var. *B*, of which he writes:—"This race comprises all those specimens in which the thorax and the superior wings are of a yellow or ochreous-testaceous colour, the costa and collar concolorous, and generally of an uniform tint, except the reniform which is darker. The specimens are generally females" ('Noctuelles,' vol. v., p. 321).

β. var. rufa, mihi.—One of the most common forms of this species is of a pale reddish-ochreous colour with scarcely any traces of markings, except the short black costal streak, dark shading in the reniform and rather paler orbicular. It appears to occur in all the localities in which I have collected.

γ. var. brunnea, mihi.—The anterior wings dark reddish-brown in colour, with the same darker and paler markings as in the last. These are as limited as in that, so that the form is almost unicolorous. It is a very common variety. A sub-variety of this reddish-brown form occurs with distinct ochreous costa, orbicular and transverse lines; the whole of the reniform dark, a dark quadrate spot between the stigmata is continued beyond the reniform as a dark wedge-shaped mark, with the inner margin (under the stigmata) also much marbled with darker = sub-var. *ochrea-brunnea*; whilst an exactly similar variety but with the pale costa, orbicular and transverse lines grey instead of ochreous = sub-var. *grisea-brunnea*. Sometimes these two sub-vars. have a very mottled appearance.

δ. var. innuba, Tr.—A peculiar dark and dull reddish-brown form occurs, which has been described by our older entomologists as "liver-coloured." The colour is seen in its best form in our ordinary, unmottled British forms of *Xylophasia hepatica*. An unicolorous variety of this form = *innuba*, Tr. Dr. Staudinger writes of *innuba*:—"Al. ant. thoraceque concoloribus" ('Catalog,' p. 81), but this is useless, as there are several different varieties which satisfy the description. Newman writes:—"The beautiful, but not uncommon variety represented in the lower figure, I have been used to call *innuba*, and it is described under that name by Stephens, but this seems to be an error, for Guenée describes that variety as 'having the costal margin and collar concolorous with the upper wings,' whereas, in the *innuba* of English entomologists, these parts are so much paler as to present a striking contrast" ('British Moths,' p. 343). Of course, Treitschke's var. is an unicolorous form and not one with a pale costa. In Humphrey and Westwood's 'British Moths,' p. 108, we read:—"Head, thorax and wings, of an uniform dark liver-brown." Of his var. *A*, Guenée writes:—"This variety comprises all those specimens in which the superior wings are of a dark hepatic-brown, little, or not at all, mixed with grey, with the

lines indistinct, the collar and the costa concolorous with the rest of the wing. The orbicular (reniform?) is generally partly filled in with brown. One finds more males than females of this variety" ('Noctuelles,' vol. v., p. 321). The name is now restricted to those dark reddish or brownish-black specimens of the unicolorous form which is generally so abundant with us. Treitschke's diagnosis of this variety is as follows:—" *Triphæna* alis anticis hepaticis; posticis flavis, fascia submarginali (a variety of the former, *T. pronuba*). " As in var. *brunnea*, there are two sub-vars. of *innuba*. One, in which the dark blackish-red ground colour has a pale ochreous costa and transverse lines, with the space between the stigmata more intensely dark and the area under the stigmata more mottled = *ochrea-innuba*; the other, in which these parts are grey = *grisea-innuba*.

ε. var. *cærulescens*, mihi.—A comparatively rare and pretty variety of the unicolorous form has the ground colour of a clear slaty-grey, with the characteristic short black costal streak near apex, and lower part of reniform rather darker, the orbicular rather lighter. A sub-var. also occurs in which the costa, transverse lines, orbicular and shading under the stigmata are of the same slaty-grey colour, but the reniform, quadrate spot between stigmata, a wedge-shaped mark beyond orbicular and parts of the inner margin of the wing, together with the areas between the outer margin, subterminal and elbowed lines are darker = sub-var. *distincta-cærulescens*.

ξ. var. *hoegei*, H.-S.—This variety is peculiar in having a black lunule to the hind wings, thus copying as it were its ally—*orbona*. Dr. Staudinger says of it:—"Minor, al. post. mac. media nigra" ('Catalog,' p. 81). Herrich-Schäffer writes:—" *Triphæna pronuba* var. *hoegei*. Of this variety, which came from Herr Höge in Hamburg, and was reared entirely from the egg, all the examples agree in the main in being small, and having a black spot in the centre of the hind wings. I do not know whether it should be considered a new species, otherwise I can only conjecture that it is a hybrid between *pronuba* and *subsequa*" ('Neue Schmet.' &c., 117-8).

Graphiphora, Och., *augur*, Fab.

The Fabrician description of this species is as follows:—" *Noctua cristata* alis incumbantibus fuscis: characteribus atris." "Caput et thorax fusca, immaculata collari erecto, cristato. Alæ anticæ fuscae characteribus variis strigaeque postica ex arcubus atris; posticæ fuscae, immaculatæ. Subtus omnes griseæ posticis puncto centrali strigaeque postica fuscis" ('Entomologia Systematica' &c., p. 66, No. 170). I consider the American *haruspica* nothing but a form of *augur*. Mr. Butler writes:—" *G. haruspica*, though very closely allied to *G. augur*, differs in being constantly much darker and usually larger" ('Trans. Ent. Soc. Lond., 1889, p. 382). Guenée says:—"American specimens are larger than ours (in France), but do not otherwise differ from them" ('Noctuelles,' vol. v., p. 325). We get two distinct dark forms in Britain, a reddish-brown form (the type) and a dark grey form (var. *hippophæes*, Hb.). These two dark forms appear to be equally distributed in this country. There is also a much paler reddish form, which is only occasionally captured in this country. This is the *omega* of Esper.

α. var. *hippophæes*, Hb.-Gey.—This greyer form is well pictured by Geyer. "The anterior wings greyish-brown with the basal and

elbowed lines very distinctly marked, the stigmata outlined in black" ('Sammlung europäischer Schmet.,' figs. 782-783). It is perhaps even commoner in Britain than the dark red-grey type.

β. var. omega, Esp.—Anterior wings of a pale reddish (almost reddish-ochreous) colour. The stigmata outlined in dark and the transverse lines dark as in the other forms. Esper's description of *omega* is:—"Alis superioribus rufescenti-cinereis, stigmatibus strigisque duabus, crenatis, nigris" ('Die Schmet. in Abbildungen' &c.). This is a rare variety in England. I have only one specimen in a very long series. This came from North London.

γ. var. helvetina, Knaggs.—I am assured by Mr. W. G. Sheldon that the *helvetina* of Knaggs is certainly a pale form of *augur*. He writes:—"About the year 1874, a young collector living at Derby, named Taylor, one evening in July, took a *Noctua* in the suburbs of that town, which, being unable to name, he forwarded to Newman who passed it round to the leading British lepidopterists of the day. Nobody could say what it was for certain, and I believe it was sent on the Continent. Doubleday was of opinion it was a var. of *N. neglecta*, and so were many others; but it was eventually named by Knaggs, *Agrotis helvetina*, and no doubt he described it at the time, though I have never seen a description. Here the matter remained for some years, when the specimen came under the observation of Dr. Mason, and after some trouble he made it out to be a var. of *augur*. I think I have seen a note in one of the magazines* (the 'Ent. Mo. Mag.,' I think) from his pen on the subject. Taylor, before he left England, about 1884, presented the specimen to Mr. G. Baker, of Burton, in whose collection I saw it in 1885, and no doubt it is there now. Speaking from recollection this is what it is like—"of the size and build of typical specimens, but the ground colour light grey or putty colour, the two black lines crossing the front wing, and those outlining the discoidal spots are there, but are not so pronounced as in the type, the fringe on the hind wings is *pink* not *grey*," there is not the slightest doubt of the species. It is said that Dr. Mason has other specimens in his collection, which approach, if they are not identical with this var. I suppose the reason it was considered to be a var. of *neglecta* was the similar colour of the fringe and the black lines crossing the wing, which are very similar in shape in both species" (*in litt.*). A very extreme pale form of a silvery, greyish-white coloration, with distinct transverse lines, was recently sent me by Mr. Dutton for inspection. It was captured near York this summer (1891).

Noctua, Linn.

This genus, closely allied to, but yet fairly separate from *Agrotis*, contains some very interesting species from the point of view of variation, but there is not the same polymorphic character exhibited by the species as in those of the latter genus. *Noctua festiva* is the most variable species both in colour and markings. *N. dahlii* and *N. neglecta* offer a wide range of colour variation, whilst *N. glareosa* varies from pale whitish-grey to intense blackish, and *N. xanthographa* goes through an almost similar range. *Festiva* variety *conflua* of Treitschke has for a long time puzzled our British lepidopterists, more particularly it would appear, because writers in the 'Entomologist' have of late years referred

* Dr. Knaggs described Continental *A. helvetina* in the 'Ent. Mo. Mag.,' vol. viii., p. 182.

to the Shetland form of this species, as well as to the small Scotch *festiva*-like form, under the name of *conflua*. These Scotch specimens are undoubtedly *festiva*, the Shetland species being the true *conflua*. There is one special point of variation in the genus worthy of notice; I refer to the C-like mark passing round the orbicular in the three closely allied species *triangulum*, *ditrapezium* and *c-nigrum*. It is formed of two quadrate spots, one, between the orbicular and reniform, the other, beyond the orbicular (nearer to the base). In *c-nigrum*, these two spots are always joined by a line passing under the orbicular; in *ditrapezium*, they are more often joined than not—in my own series, about three-quarters are thus joined; in *triangulum*, there are much fewer specimens having them joined than distinct. The shape of the mark thus made varies greatly, from two solid blocks with a line joining them, to a solid-looking letter C, whilst frequently the normally quadrate spots become somewhat triangular in shape, and thus tend more or less to obsolescence. It is remarkable that the same superficial mark is developed in *Tæniocampa gothica* and goes through the same gradations.

Noctua, Linn., *castanea*, Esp.

Esper's diagnosis of the type of this species is:—"Alis superioribus supra rufis; inferioribus supra, omnibus subtus nigricantibus" ('Die Schmet.' &c., p. 27). His fig. 11, Pl. 187, of the same work may be described as:—"Unicolorous bright red, with white nervures on outer margin." This is the *cerasina* of Guenée but not of Freyer. Guenée writes:—"This does not differ absolutely from *neglecta*, except by its deep brick-red colour, which absorbs the stigmata and a part of the markings, otherwise I should consider it a simple variety. However, I leave the question to be finally settled by those who shall rear and compare the larvæ of the two species. I may add, to make the matter clearer, that I have more than once found varieties of *neglecta* very similar to Freyer's figure (of *cerasina*)" ('Noctuelles,' v., pp. 336 and 337). There are, in this species, three ordinarily common forms—the red form = the type, an intermediate form = var. *cerasina* and a dark grey form = var. *neglecta*. Besides these, and far more beautiful than either of them, there is a variety, a specimen of which has kindly been given to me by Mr. Horne of Aberdeen, and named as var. *pallida*. In the 'Entomologist,' vol. x., p. 32, we read:—"Helvetina was introduced into the British list in error. The examples turn out to be the red variety (*castanea*, Esp., which is really the type) of *Noctua neglecta*" ('Entom.,' viii., 135). I am assured by Mr. W. G. Sheldon, that this is not so, but that the pale specimen is a variety of *Graphiphora augur* (ante p. 103).

a. var. *neglecta*, Hb.—This is treated as the type by Guenée, and Staudinger writes of it:—"Grisea-quæ var. frequentior" ('Catalog,' p. 81). This form seems to have a much wider range than the type, which appears to be practically restricted to Britain and Germany. Hübner's type has "the fore wings of a dull grey colour; with an abbreviated, followed by a complete, wavy, black transverse line; the stigmata outlined in darker; basal part of reniform filled in with black; an indistinct elbowed line beyond the reniform followed by a row of dots, then by a broad red subterminal line intersected throughout its length by a pale one; fringes reddish. Hind wings dark grey, paler base (no markings)" ('Sammlung europ. Schmet.,' fig. 160). This grey form is the commonest of all the varieties of *castanea*. It occurs in all localities where the species is found in Britain.

β. var. lævis, Haw.—This form is intermediate between the type and *var. neglecta* in colour, being of a reddish-grey. Haworth's description is:—"Alis cano sub-rufescentibus, strigis obsoletissimis punctoque medio fusco, posticis perfuscis." "Strigæ fere ut in *N. tetragona* (= *xantographa* var.), at tenuiores et obsoletiores, nisi lente vix conspicuæ. Stigma anticum deest; posticum reniforme, margine solo manifestatum basi puncto nigro. Cilia anticarum sordide rufescentia, posticarum pallidiora" ('*Lepidoptera Britannica*,' p. 207). This is the same form as the *cerasina* of Fieyer, the anterior wings of which are of a dark purplish-red, unicolorous, except a pale subterminal line, which is margined on its inner edge with blackish, and having a very faint outline to reniform. Hind wings dark blackish-grey" ('*Neuere Beiträge*,' pl. 312). *Lævis* is almost as common in Britain as the purely grey form, *neglecta*. I have it from several Scotch localities extending from Aberdeen in Scotland to Shirley in Surrey.

γ. var. pallida, mihi.—This beautiful variety, given to me by Mr. Horne, was captured at Aberdeen. It is totally unlike any of the other forms, being of a pale whitish-ochreous ground colour, with the reniform and orbicular outlined in red; the subterminal line is composed of a series of red dots; otherwise the specimen is unicolorous without any other transverse lines. I have only seen the specimen mentioned above, which is in my collection.

Noctua, Linn., *baia*, Fab.

The red form of this species is the type, and is thus described by Fabricius:—"N. cristata alis deflexis ferrugineis: puncto parvo baseos geminatoque apicis nigris." "Rustica media. Palpi ferruginei apice pallidi. Thorax ferrugineus. Abdomen cinereum. Alæ anticæ ferrugineæ puncto baseos distincto atro, in medio paullo obscuriores maculis ordinariis et apice versus marginem anteriorem puncta duo approximata atra. Posticæ fuscae ciliis ferrugineis" ('*Mantissa*,' pp. 175-176). In Humphrey and Westwood's '*British Moths*,' pp. 130-131, we read:—"This species varies from $1\frac{1}{2}$ to $1\frac{2}{3}$ inch in the expansion of the fore wings, which are of a grey or brownish-grey colour, somewhat clouded, and obsoletely strigated with several rows of dusky dots or slightly distinguishable lunules; the stigmata are not very distinct, the anterior having a pale circle edged slightly with dusky, and the outer stigma large and reniform with a pale margin; beyond the latter runs a curved pale striga, followed by another rather darker than the ground colour of the wing, having a blackish apical patch on the costa. The hind wings are reddish-grey, with the margin darker and cilia rufescent. The female is darker-coloured with the strigæ more obsolete." There is no doubt that the *tricomma* of Esper also represents the type. It is described as:—"Alis superioribus ruf(f)escentibus strigis oblit(er)atis fuscis, apice maculis tribus contiguis nigris; inferioribus flavescentibus" ('*Die Schmet. in Abbildungen*' &c., p. 603, Pl. 167, fig. 6). There are two very distinct forms in this species; pale greyish and red-brown. There are also two other forms, one, of a clear, purplish coloration, another, with a distinct slaty tinge as in certain varieties of *Noctua sobrina*, *Agrotis hyperborea* &c., but the red (the type) is by far the most common form. Sexual variation is exhibited in the colour of the hind wings, those of the males being paler than those of the females. The black apical dash is found to consist of one, two or three indistinct dots. None of my specimens have this dash quite obsolete, although some

have it nearly so. The central shade is variable in intensity and slightly so in position, sometimes passing between the orbicular and reniform. The red form, which we take as the type, is very variable in intensity, sometimes inclining to grey, at others, being quite ferruginous in tint.

α. var. purpurea, mihi.—This variety has the red tinted with a beautiful purplish or plum-colour, and not of the ferruginous shade as in the type, and hence has a much richer appearance than any of the other forms, and reminds one of the lovely violet or purple tinge seen on some specimens of *N. brunnea*. The form is very rare. I have only three specimens, one from Perth, another from Warrington, and a third, which I captured at Freshwater. In one of these specimens (from Perth), the tiny pale costal streaks, just before the black apical streak, unite and become developed into a narrow longitudinal line of a pure white colour, running along the costa from just above the reniform to the black apical streak, reminding one of *Hydræcia nictitans* var. *albicosta*, but in this specimen of *baia*, the white line is only developed on the right side, the pale costal marks being quite normal on the left.

β. var. grisea, mihi.—The anterior wings of this variety are of a pale greyish-fuscous colour, sometimes with a slight ochreous tinge. The stigmata, transverse lines, central fascia, &c. vary as in the type. It is a comparatively rare form, but I have specimens from Freshwater, Chattenden, Morpeth, Wicken and Deal.

γ. var. cærulescens, mihi.—This variety has the ground colour of the type, with a distinct slaty tinge, which is very noticeable and striking in the basal and costal areas. This form of variation is very rare; my specimens have come from Perth, Chattenden, Deal and Wicken.

Noctua, Linn., *sobrina*, Gn.

This species is generally given as named by Guenée. Guenée himself gives "*Boisduval (in litt.)*" as the nomenclator. Staudinger quotes Guenée ('Ann. Soc. France,' 1841, p. 239) as the reference for Guenée's naming the species, but this is only a catalogue or list name. In the '*Noctuelles*,' pp. 335-336, Guenée only describes the larva, and it is only by his comparison in the description of var. *gruneri* that we find that the type is a form with "red upper wings." Our British specimens, so far as I know, are represented by two distinct forms, one, dull reddish-grey with indistinct markings, from the Rannoch district, the other, from Perth, much more rosy on the outer margin (beyond the elbowed line) and centre of the wing, but with the basal half to the median transverse shade covered with whitish scales and powdered with similar scales all along the nervures, giving the insect a regular slaty appearance. This latter form would appear to be the var. *mista* of Freyer, as the outer area is much too red for var. *gruneri*. Strange to say, the males and females of the Rannoch form are of one size, the females of the Perth form are usually much smaller than the males.

α. var. gruneri, Gn.—Guenée gave this name to a variety from the Eastern Pyrenees, and described it as:—"Larger. The reddish colour of the superior wings replaced by ashy-white, tinted slightly with rosy. Inferior wings paler" ('*Noctuelles*,' vol. v., p. 336). It is the *sobrina* of Duponchel, but the *lapponica* of Freyer, given by Staudinger as a synonym, appears to me to be *N. castanea*. Staudinger says of *gruneri*:—"Major, grisescens" ('Catalog,' p. 80). This appears to lead up to

var. *mista*, which is the form of the species usually obtained in the Perth district.

β. var. *mista*, Frr.—The type of this variety may be thus described:—"Anterior wings of a bright red, with a complete basal line; the basal area (between this line and the base) slaty-grey; the costa also slaty-grey to the elbowed line, which, with the median and basal lines is also slaty; a transverse black dash between the stigmata which are surrounded with darker red than the ground colour; a series of black shades on nervures between the elbowed and subterminal lines. Hind wings dark grey, base paler, lunule distinct" ('*Neuere Beiträge*' &c., pl. 441, fig. 3). The "black dash between the stigmata" is absent, and the stigmata are surrounded with pale ochreous and not with "darker red than the ground colour" in the Perthshire form. Otherwise our specimens from that locality agree exactly with *mista*, and must be included under that varietal name. The most peculiar character in the Perth specimens (so far as my series is concerned) is that the males are uniformly larger than the females. This variety would appear to be the *sobrina* of Duponchel, pl. 69, fig. 5A. His description corresponding with this fig. is:—"The superior wings above are reddish-brown with their bases powdered with bluish-grey, traversed by two wavy, brown undulated lines, between which are the ordinary stigmata outlined in clear reddish. The reniform small and its lower part filled in with a large black spot. Between the second line and the terminal edge, one notices at once a wavy row of small black points, followed immediately by a clear reddish line, equally wavy, near the hind margin. Inferior wings shiny greyish-ochreous with reddish fringe and dark lunule" ('*Histoire naturelle*' &c., Supp. iv., p. 224).

γ. var. *suffusa*, mihi.—This variety is the dullest and least strongly marked of all the forms of *sobrina*. My specimens all came from Rannoch, and have the anterior wings of a dull dark grey colour with the slightest reddish tint. In fact, one specimen is entirely without such a tint, whilst in another there is a very slight tinge of ochreous. The basal area is only slightly powdered with grey, the nervures being still less so. The orbicular varies in size, shape and character, the transverse lines are indistinct, the basal lines are darker, the lower part of the reniform darker, the nervures slightly dusted with pale grey at their bases; altogether it is a most unicolorous form. The males and female in my series of this form are of uniform size and not dimorphic as is apparently the case in the Perth form. Duponchel's pl. 69, fig. 5B is like the Rannoch specimens, dull brownish-grey, not ashy-white as Guenée describes *gruneri*.

Noctua, Linn., *glareosa*, Esp.

This species has a wide variation in ground colour, which extends from a pure whitish-grey to black, the characteristic short, black transverse marks, however, being very constant in all its forms of variation, and standing out conspicuously even in the darkest specimens. These darkest specimens are, I believe, almost peculiar to the Shetland Isles, and are excessively rare elsewhere, although there is a record by Mr. Wylie in the '*Entomologist's Record*' &c., vol. i., p. 11, of three black specimens being captured in 1887, near Perth. There is also a beautiful variety tinged with a delicate rosy colour, as was mentioned in vol. i., p. 11, of this work, as being of frequent occurrence in those

species of *Cuspidia* and *Viminia*, which have a similar grey ground colour. Esper's diagnosis of this species is:—"Alis cinerascentibus, punctis baseos et pupillis stigmatum nigris; strigis tribus posterioribus albidis" ('Die Schmet. in Abbildungen' &c., p. 387). Our own pale specimens are distinctly of two forms, one, of a pale whitish-grey, the second, of a pale lilac-grey, the former being the more common form found on the Continent, the deepening in tint in some of our specimens being, perhaps, a foreshadowing of the intense melanism which is so characteristic of the Shetland Isles and probably of the Scotch Highlands. The *hebraica* of Hübner is almost typical, having the space between the two outer transverse lines of a rather darker grey" ('Sammlung europäischer Schmet.,' fig. 642). I have never seen specimens actually intermediate between the grey and black forms, but Mr. Wylie writes:—"During 1887, I took a great number of this species, varying from black to the normal type, with many intermediate forms and rosy vars." ('Entomologist's Record' &c., vol. i., p. 11). The Morpeth form, too, sometimes runs very dark grey.

a. var. rosea, mihi.—This beautiful variety of *glareosa* has the ground colour of a delicate lilac-grey, tinted all over with beautiful rose colour, and thus offers a parallel form of variation to that obtaining in certain species of *Viminia* and *Cuspidia*. I have many specimens thus tinted, from different Scotch and English localities. This is the var. *A* of Guenée, who writes:—"The ashy-grey replaced by a rosy tint." "I once reared a specimen from the larva" ('Noctuelles,' vol. v., p. 324). The *I-geminum* of Duponchel is intermediate between the type and var. *rosea*, having the basal part grey and the outer rosy. Duponchel's description is:—"It has the superior wings above, of a pale bluish-grey, extending from the base almost to the middle of the wing, the remaining outer area being reddish-grey; there are three transverse lines, pale grey in colour; one wavy, near the outer margin, the second arched, a little nearer the centre, and the third, equally arched, at a little distance from the base. Between these last, one notices a sharp black mark which fills the space between the ordinary stigmata, of which the orbicular is almost effaced. A somewhat similar black mark is situated between the orbicular and third (basal) transverse line, whilst two black contiguous streaks are situated a little from the base. The fringe is separated from the outer edge by a row of black dots. The inferior wings are of a reddish-white with brown nervures" ('Histoire naturelle' &c., pp. 88.89, pl. 77, fig. 6).

β. var. suffusa, mihi.—"This is one of the gems of the collection; the ground colour of the upper wings, instead of the usual grey, is of a rich dark brown, *vide* fig. 1." So writes Mr. J. Jenner Weir, in the 'Entomologist,' vol. xvii., p. 2, of the melanic forms of *glareosa* in the collection of lepidoptera made by Mr. McArthur, at Unst, and figured very unsatisfactorily in connection with Mr. Weir's remarks. This beautiful variety, almost peculiar to the extreme northern part of the British Islands, may be described as having the anterior wings brownish-black, with the transverse lines rather paler, whilst the quadrate spot between the stigmata, the black mark between the orbicular and transverse basal line, and the basal dots are of a still more intense black. It is recorded, 'Entomologist's Record' &c., vol. i., p. 11, as captured by Mr. Wylie near Perth. He writes:—"Very dark varieties of this species have been frequently recorded from the Shetland Isles, but on the 18th of August, 1887, while sugaring on Kinnoull Hill,

near Perth, I took three black forms of *N. glareosa*."

Noctua, Linn., *depuncta*, Linn.

The Linnæan description of this species is as follows:—" *Phalæna Noctua depuncta spirilinguis cristata, alis grisescentibus: lituris marginalibus nigricantibus, strigaeque postica punctata.*" "Media. Alæ superiores cinereæ sed subgrisescentes: puncta 2 nigra ad basin; dein puncta 2 sed 3 nigra connata in lituram ad marginem crassiorem; tum macula ovata et reniformis; tandem striga obsoleta obscurior: demum ordo transversus e punctis nigris minutissimis; margo posticus alæ obscurior. Subtus alæ pallidæ puncto et fascia lineari transversa nigricante" ('Fauna Suecica,' p. 321, No. 1214). Our Forres specimens are more ochreous than the Linnæan type, so far as the description of the latter allows one to suppose. Hübner figures our brownish-ochreous form (fig. 502) as *mendosa*, but his fig. 120 is very different to anything I have ever seen among British *depuncta*, although both Guenée and Dr. Staudinger agree in referring it to this species. Newman, in his 'British Moths,' p. 344, gives "ochreous-grey" as the ground colour, and I think the Carlisle specimens are occasionally a trifle greyer than the Scotch, although the former are described as "rather bright buff-coloured pale brown shaded with darker brown" in Humphrey and Westwood's 'British Moths,' p. 130, and this is their usual colour. I find, on reference to the Doubleday collection in the British Museum, that the Scandinavian form of *depuncta* is very unlike ours. The specimens are much larger, of a slaty-grey colour (as in the Linnæan description), with a very faint reddish tinge; the markings, however, being quite typical.

a. var. mendosa, Hb.—So different is Hübner's fig. 120, that I think it advisable to give a separate description of it. "The space beyond the subterminal line is rosy red, the ground colour of the remainder of the wing reddish-brown with a bright red spot on the costa at the base. The outer transverse line reddish, the elbowed line ochreous, with a black costal point on the inner edge of both these lines; a dark patch between the stigmata, and another beyond the orbicular, with two black dots on the abbreviated basal line. Hind wings slaty-grey" ('Sammlung europäischer Schmet.' &c., fig. 120). I cannot but think that this figure is highly coloured, but meant to represent a particularly red specimen of our more ochreous and reddish form, as Hübner figures in the same work another specimen, quite typical of our British specimens. Of this fig. 502, I wrote:—"It (*mendosa*) is a good figure of our North British *depuncta*, with the nervures hardly so faint; the ground colour of a deep brownish-ochreous, hind wings grey, with a distinct lunule." All our British specimens would appear to be referable to var. *mendosa*.

Noctua, Linn., *triangulum*, Hufn.

Hufnagel's description of the type is as follows:—"The double triangle. Fore wings reddish-yellow or brown, with a large brown spot which represents two triangles meeting at their apices" ('Berlinisches Magazin,' iii., 306). Guenée writes of it:—"It is one of the most common species of *Noctua*. It varies slightly with us in the intensity of the ground colour" ('Noctuelles,' vol. v., p. 330). There are three shades of ground colour found in our British specimens. The first is a very rare form, red in colour = the type; the second, grey, tinted

with red or purplish = *sigma*, Haw. ; the last, pale grey, with no trace of red = *sigma*, Hb. The *sigma* of Haworth is the commonest form, and appears to be the most widely distributed. There is a great deal of variation in the quadrate spots before and beyond the orbicular. Generally they are separate, but often they are united, with every gradation ; the most opposite forms having two distinct quadrate spots when quite separate, and a distinct arch when they are completely joined. There is some variation in the depth of colouring and intensity of development in the transverse lines, sometimes the latter are quite obsolete. There is also occasionally a trace of a transverse shade and a little mottling under the stigmata. Guenée describes a var. *A*, of which he writes :—“ The black space which separates the two stigmata, narrower, more concave at the extremities, without black spots at the abbreviated basal line.” “ From the State of New York ” (‘ Noctuelles,’ vol. v., p. 330).

a. var. intermedia, mihi. = *sigma*, Haw.—The *sigma* of Haworth is intermediate between the red type and the pale *sigma* of Hübner. His diagnosis is :—“ *Noctua alis griseo-purpurascens atro maculatis ; stigmatum marginibus strigisque quatuor pallidis nigro adnatis.*” “ Abdomen fuscum, ani barbâ rufâ. Alæ anticæ strigis quatuor ordinariis pallidis obsoletis ; viz. duabus ante, duabusque aliis pone stigmata margine subluteo nigro adnato conspicua. Macula atra ante, alteraque inter stigmata ut in ultima : macula alia parva basi, et quatuor vel quinque costales, una parum major juxta apicem, exacte ut in *N. baja*, quæ ad strigam quartam attingat ” (‘ Lepidoptera Britannica,’ p. 225).

β. var. sigma, Hb.—This is the palest form of the species. Hübner’s form is pale grey in colour, with the markings around the stigmata very black. The costal spots are geminated, the median nervure pale with a slight red shade just under the stigmata, below the median nervure ” (‘ Sammlung europ. Schmet.,’ fig. 497). This is the var. *β* of Haworth’s *sigma*, which he describes as :—“ *Alis albidis vel albicantibus, characteribus fere ut in a (= sigma, Haw.)* ” (‘ Lep. Brit.,’ p. 225).

Noctua, Linn., *c-nigrum*, Linn.

The Linnæan description of this common species is as follows :—“ *Noctua spirilinguis cristata, alis depressis cinereis : macula nigra ex-tus obsoleta lineolaque apicis atra.*” “ Lineola nigra ante apicem ad marginem anteriorem ” (‘ Systema Naturæ,’ x., p. 516). To which is added in the ‘ Fauna Suecicæ,’ pp. 316-317 :—“ *Alæ superiores supra cinereæ, macula laterali atra, oblonga, arcuata in sinu lutea ; macula reni-formis flavescens ; litura nigra versus marginem posticum. Alæ inferiores supra fere niveæ. Alæ omnes subtus cinerascens arcu magno obsoleto fusco, literam C mentiente. Thorax antice griseus.*” This species has the C-like mark round the orbicular very complete, although variable in minor particulars of shape. I have no specimen in which the two quadrate spots are distinct.

a. var. numatrum, Esp.—Of this variety Guenée writes :—“ *Paler, the ordinary lines obliterated, a row of interrupted black dots, terminal space very black.*” He also adds :—“ This variety, which is generally accidental, must not be confounded with the *N. numatrum* of the ‘ Wien. Verz.,’ which is the *gothica* of Linnæus ” (‘ Noctuelles,’ vol. v., p. 328). Esper writes :—“ The authors of the ‘ System. Verz.’ have not noted *Ph. gothica* by the Linnæan name, but they mention it by the name *numatrum*, under which name I have received it from those parts. The

black mark in the middle of the fore wings resemble a Hebrew letter, **ז**. Linnæus found some resemblance to a letter in Gothic writing, hence the name *gothica* arose." After pointing out the error of the authors of the 'System Verz.', he added under the same name (*numatrum*), and figured under the name of *singularis*, what he considered two vars. of *gothica*, but which prove to be a var. of *c-nigrum*. Of this he writes:—"In the third figure I have still pictured another moth which agrees with the principal markings (of *gothica*), but varies considerably. The black mark in the fore wings is here of different shape; it is very narrow, and both ends rise equally; the black streak towards the inner margin is absent, and an interrupted line runs through the wing instead of the lighter streaks. The outer line, too, has a blackish border" ('Die Schmet. in Abbildungen,' iii., p. 384, pl. 76, fig. 3).

β. var. suffusa, mihi.—This is the var. A of Guenée, who writes:—"Of a deep violet-black. The pale costal blotch of a reddish flesh-colour; inferior wings dark greyish-black, as in *ditrapezium*." "North America." "Despite the colour of the inferior wings of this Noctuelle, the designs are so exactly similar to those of our *c-nigrum*, that I dare not make it a separate species" ('Noctuelles,' vol. v., p. 248).

γ. var. rosea, mihi.—This is Guenée's var. B, of which he writes:—"Of a clear testaceous, slightly rosy, with the cellular spots (between the stigmata) and the spot at the base, alone black. The subterminal line spotted, blackish, distinct." "Pondicherry" ('Noctuelles,' vol. v., pp. 328-329). The form in which the clear ground colour is slightly rosy, is occasionally found in Britain.

Noctua, Linn., *ditrapezium*, Bkh.

Of this species there appear to be red, and dark red-brown forms, but these, so far as I can judge, represent the sexes, the red form being males, the duller coloured form, females, and, whilst Borkhausen describes the male, Treitschke describes the female as *tristigma*, and Godart as a var. of *sigma*. Treitschke's description is:—"Noctua alis anticis fusco brunneis, macula rhomboidea, altera triangulari tertiae baseos irregulari atris" ('Die Schmet.' vol. v., 1st part, p. 243). The fig. 3, Plate 61, of Godart and Duponchel's 'Histoire naturelle' &c., is a beautiful reproduction of the female, under the name of *sigma*, and from his letterpress, p. 17, we learn that he considered the male a variety of his *sigma* (the female), for he writes:—"The *N. ditrapezium* of Hübner and of Borkhausen, and the *Graphiphora tristigma* of Ochsenheimer (Treitschke) certainly form only a variety of *sigma*. It differs in having the upper wings with a more violet tinge, and the three transverse lines are ferruginous instead of black, otherwise the markings are exactly the same." This is exactly it, only Borkhausen's redder form is the type, and Duponchel's *sigma* would be the var., if it were not apparently only the other sex. Borkhausen's description is:—"The ground colour of the fore wings is reddish-brown tinged here and there with pale grey. Near the base is a small black spot which joins the abbreviated basal line. This is followed by a dark brown wavy transverse line. On this stands a blackish-brown square-shaped or trapezoidal spot, which joins, under the orbicular, another such spot between the reniform and orbicular. A small narrow shade crosses the reniform, followed by the elbowed line, whilst beyond this is the subterminal line. Between the elbowed and subterminal lines

stand three transverse series of dark dots, the central one being clearer. The hind wings have a dark brown margin and a dark lunule" ('Naturgeschichte' &c., pp. 515-516). In this species the quadrate spot between the stigmata is usually joined to the spot beyond the orbicular, although frequently they are not thus joined. Guenée writes:—"It is nearer to *c-nigrum* than to *triangulum* and *rhomboidea*. Its distinctive characters are the same as for *triangulum*, except the following differences:—"Superior wings narrower, of a dark violet-brown; subterminal line almost absent; reniform spot normal, having in its centre a grey C; inferior wings ochreous, with a darker lunule and outer border" ('Noctuelles,' vol. v., p. 329).

Noctua, Linn., *stigmatica*, Hb.

This species, which is generally known in Britain by Treitschke's name *rhomboidea*, has two very distinct forms. The first is red-brown = the type, the second is dark purple-brown = *tristigma*, Stephens. Hübner's figures may be described as:—"♂. Anterior wings of a bright red-brown colour, with a dark quadrate spot between the stigmata." "♀. Anterior wings brownish-ochreous, with two dark spots, one, between the stigmata, the other, beyond the orbicular; an oval black spot under the orbicular. Posterior wings, alike in both sexes, of an ochreous-brown colour" ('Sammlung europ. Schmet.' &c., figs. 470-471). The *rhomboidea* of Treitschke is also the typical form. His diagnosis is:—"Noctua alis anticis rubro-brunneis, macula *rhomboidea* alterave triangulari fusco nigris" ('Die Schmet.' &c., vol. v., 1st part, p. 231). Of this species Guenée writes:—"The distinctive characters of this species are:—"Wings violet-brown, the abbreviated basal line without an adherent black spot; the orbicular rounded at the bottom; the elbowed line ill-developed; subterminal line ochreous, indistinct, very wavy, preceded by a brown shade; equally developed throughout and without apical spots. Inferior wings of a very dark brown'" ('Noctuelles,' vol. v., p. 330).

a. var. tristigma, St.—This variety is thus treated in Humphrey and Westwood's 'British Moths,' p. 129:—"It has much of the character and appearance of *Graphiphora brunnea*, the fore wings and body being of a dark rich purplish-brown colour varied with strigæ as in that species; close to the base of the wing is a black spot of variable form and size, another black patch is placed immediately before the basal stigma and extends backwards, and there is a third rhomboidal spot of the same colour between the stigmata, both of which are of a brown colour, thus differing from *G. brunnea*; beyond the second stigma is a narrow and much curved pale striga, followed by a broader, irregular dark one, the succeeding space being of the ground colour of the wings, minutely speckled with ochre colour. The hind wings are pale grey-brown with the hind margin darker; the cilia of all the wings are rosy-brown. Mr. Humphrey has observed that the anterior tarsi are annulated with black and white, whereas they are light brown in *Graphiphora brunnea*, with the last joint black." This rich, dark purplish-brown variety is the form that has been captured during the last few years by Mr. Holland at Reading.

Noctua, Linn., *brunnea*, Fab.

This is a beautiful and variable species, but the variation is difficult to deal with. There are a bright red form and a dark purplish-brown

form, the latter approaching *stigmatica* var. *tristigma* in colour. The quadrate spot in the darker specimens is very intense, but in some of the brighter red forms, it assumes the ground coloration of the rest of the wing. Occasionally, too, specimens are much marbled with ochreous in the central area of the wing, but the development and arrangement are very erratic. The diagnosis of Fabricius is as follows:—“*Noctua cristata*, alis deflexis fuscis; macula media transversa flava, margine brunneo.” “*Alæ anticæ fuscæ maculis aliquot in primis marginis exterioris fuscis*. In medio loco maculæ ordinariæ posticæ macula transversa flava. Margo alæ ipse brunneus. Posticæ fuscæ margine brunneo” (‘*Mantissa*,’ p. 168, No. 223). The purely brown type is rare in Britain, and, of the purple forms, that with the central area mottled with reddish and ochreous is more common than the entirely purplish-black form. The mottled form is the *lucifera* of Esper, the unmottled and darker form is probably the ab. *nigricans* of Homeyer. The *fragariæ* of Vieweg represents the same brown typical form as the *brunnea* of Fabricius.

a. var. *lucifera*, Esp.—This is the beautiful purplish variety of *brunnea*, which seems to be distributed everywhere in Britain with, and to be more common than, the redder forms. Esper’s Plate 142, fig. 6, has “the anterior wings of a dark purple colour, with the central area, from the complete basal line to the elbowed line, reddish; a very dark transverse shade encloses the reniform, and a dark shade extends transversely between the elbowed and subterminal lines. The reniform and orbicular stigmata are outlined in yellow.” Esper’s diagnosis is:—“*Alis deflexis ruf(f)is nebulosis stigmatibus luteis, macula intermedia nigra, fasciæque maculari fulva*.” “The ground colour of the fore wings of a rich reddish, with the base and outer margin showing a strong violet tinge. The stigmata are ochreous, and between them stands a quadrate black spot” (‘*Die Schmet. in Abbildungen*,’ p. 453).

β. var. *nigricans*, Homeyer.—In the ‘*Entomologisk Tidskrift*,’ 1885, M. Sven Lampa mentions an “ab. *nigricans* A. v. Homeyer (*in litt.*)”, which he describes as:—“*svartaktig*,” and gives as localities “*Sverige* and *Öland*.” I am inclined to think that this refers to our purely purplish-black form. If so, it is not at all uncommon in Britain.

γ. var. *rufa*, mihi.—The red colour, characteristic of the middle area of the wing in var. *lucifera*, is, in this variety, spread all over the wing, so that the anterior wings are of a bright red colour, with the stigmata yellowish as in the other forms, but the black quadrate spot between the stigmata is often no darker than the remaining area of the wing. This is a rare form compared with var. *lucifera*, but not nearly so rare as the brown type.

Noctua, Linn., *dahlîi*, Hb.

This species, which is very variable, although it is difficult to classify the varieties, has two very distinct forms in Britain. Our English specimens are generally more or less marked and shaded with ochreous, whilst the Scotch and Irish examples are very much redder. The former is the type, and is represented by Lübner’s fig. 465. This is a “male, with the anterior wings of a yellowish-brown colour, distinctly crossed by transverse lines, and has a very mottled appearance” (‘*Sammlung europ. Schmet.*’ &c.). This male is exactly like some of

the Wharncliffe specimens sent me some years ago by the York collectors. Hübner's fig. 416 is a ♀, and agrees more with the Scotch form, but is still marked with ochreous stigmata. "The anterior wings are purplish-red in colour, with the reniform stigma yellow, the orbicular the same shade as the ground colour, but outlined in paler." Guenée writes of *dahlia*:—"This varies no less than *festiva*. I am assured that the *candelisequa* of Stephens is only the female of this species, but how can we apply his description, above all the words 'alis griseis glauco-pruinosis?' " ('Noctuelles,' v., p. 330). Glaucous forms of *dahlia* are much rarer than in *festiva*, *baia* and *sobrina*, but are occasionally met with. Of the other two forms, the ochreous marbled, chestnut forms are more often (but not exclusively) in England, males, the red, females; in Scotland and Ireland, both sexes are usually reddish or purplish-brown. My specimens of the type have come from Wharncliffe, Sherwood Forest and Aberdeen. This mottled type form is the *erythrocephala* of Haworth. His diagnosis is:—"Noctua alis griseo-ferrugineis macula inter stigmata fasciæque postica castaneis." "Præcedentibus duabus (*subrufa* and *festiva*) certe affinis. Differt staturâ minore, maculâ inter stigmata rufo-castaneâ vix quadratâ, sed magis rotundâ, denique fasciâ fusco-castaneâ parum undulatâ inter stigmata et marginem posticum. Alæ posticæ perfusæ, lunulâ in medio, nigrâ. Cætera ut in præcedentibus" ('Lepidoptera Britannica,' p. 227).

a. var. rufa, mihi.—Taking the chestnut coloured, more marbled form of *dahlia* as the type, I would call the redder form *var. rufa*. The anterior wings are of a deep reddish-brown, frequently tinged with purple, with the central area not distinctly mottled, but with well-marked stigmata. My specimens have come chiefly from Sligo and Aberdeen, but I have specimens from Howth and other localities. When this form is tinged with glaucous, it becomes the *candelisequa* of Stephens.

β. var. candelisequa, St.—Of *candelisequa*, St., Humphrey and Westwood write:—"The fore wings are of a red-brown colour irrorated with glaucous, the dusky strigæ occasionally very indistinct; the first, abbreviated, behind (at base), succeeded by a dot, a second, undulated, before the anterior stigma, another, dentated beyond the outer stigma, succeeded by a paler one slightly undulated: the stigmata are pale luteous-brown, edged with a dusky line, and greyish in the middle; there is also a dusky dot behind the anterior stigma in the place of the supplemental one, and there is a row of marginal black spots. The hind wings are luteous-brown, with the margin darker. The cilia are pale reddish. The antennæ are exceedingly slender, with the ciliations scarcely perceptible. The abdomen is pale luteous-brown" ('British Moths,' p. 128). It is very rarely one gets a glaucous-tinged specimen, although I have seen such, and, in some of the allied species, *sobrina*, *baia*, *festiva* &c., glaucous forms are not at all uncommon. Mr. Stephens' type came from Darenth Wood.

γ. Guenée describes a *var. A* from America, as follows:—"Paler, with the designs partly obliterated, the orbicular proportionally large, the reniform outlined but not filled in with yellow." "State of New York" ('Noctuelles,' vol. v., p. 332). Perhaps such varieties may be in some of our British collections.

Noctua festiva and *N. conflua*.

We now come to the most variable and interesting of all the species in

this genus. The interest in them has been greatly enhanced owing to the discovery in the Shetland Isles of forms totally unlike those obtainable in England, Ireland and, so far, on the mainland of Scotland. Of these Shetland examples, which are the true *conflua*, Mr. J. Jenner Weir writes:—"This insect varies much; some resemble the ordinary varieties of *conflua*, others are in coloration more like *N. dahlii*, and others are very like *N. brunnea*; all are darker than the normal *N. festiva*. Some have a hoary appearance, and indeed present such singular differences that I do not doubt, if the more remarkable aberrations were examined separately, they would, in the absence of links, be regarded as distinct species" ('Entomologist,' vol. xiii., p. 289); and, writing of 'the Lepidoptera of Unst,' the same gentleman remarks again of true *conflua*:—"A most beautiful series of this species was captured, some of a very rich chestnut colour with well-defined markings, as rich in colour as *N. brunnea*; and others of the var. *conflua* with markings almost obsolete. Of these, three varieties are figured,* Nos. 8, 9 and 10" ('Entomologist,' vol. xvii., p. 2). Of the general variation of ordinary *Noctua festiva*, Newman writes:—"This moth is exceedingly variable. Through the kindness of friends I have at times possessed hundreds of specimens, of which I can truly say that no two were exactly alike" ('British Moths,' p. 349). The endless variation to which this species is subjected, the remarkable connection between this and the small race, erroneously known as *conflua*, which is captured on the moors of North England and in Scotland, together with the occurrence of the true *conflua* (agreeing exactly with Icelandic specimens) in the Shetland Isles with *festiva*, make this one of the most interesting of our NOCTUÆ.

The small form of *festiva*, generally known as *conflua* in Britain and on the Continent, is not the *conflua* of Treitschke, which represents the Shetland and Iceland form lately introduced into our lists as var. *thulei*. I have not the remotest doubt that this true Iceland and Shetland *conflua* is a good and distinct sub-species, having nothing in common with the small specimens of *festiva* which are picked out from hundreds of the larger forms by our Scotch collectors, and distributed broadcast into our English collections as *conflua*. This error was due primarily to Newman, who treated this small race of *festiva* as a distinct species under the name of *conflua* in his 'British Moths,' p. 349, erroneously supposing that these small *festiva* were Treitschke's *conflua*. Of Newman's so-called *conflua*, Mr. Reid of Pitcaple writes:—"There is no difference between the specimens sent out from Aberdeenshire as *festiva* and *conflua*. Collectors pick out all the small specimens and call them *conflua* (because it is so in Newman's 'British Moths'), and all the large ones and call them *festiva*. They (both large and small) occur together here in all localities, almost from the sea-level to several hundred feet above the sea" (*in litt.*). I have some two hundred specimens in my series from different localities in Scotland and England, and it is impossible to get from the mainland of Scotland, so far as we at present know, a single form that cannot be obtained occasionally in our Kent woods. Some of my smallest examples are from Kent, and some of my largest from Perth and Aberdeen. Of course, local environment causes some little difference in the appearance of such a common species, and a tendency to glaucous is more frequent in the Aberdeen and Darlington districts

* The figures are very bad, and utterly useless for reference. J. W. T.

than elsewhere, the reddest specimens I have ever seen coming from Perth and Chattenden (Kent), widely distant localities enough. True *festiva* and our forms erroneously called *conflua*, in their reddest varieties are bright red, more like the red of bright *Noctua rubi* but even brighter than the brightest of these, still there is none of the dull-brown colour in these *festiva* vars. that is characteristic of the true Icelandic and Shetlandic *conflua*, the reddest of which resemble somewhat in colour the red-brown type of *N. baia*. These specimens, too, have a differently shaped wing as mentioned by Herr Hoffmann in his extract quoted below, and this is quite a constant character, whilst no Scotch *conflua*, so-called, exhibit this essential character, whatever their size. That the so-called *conflua* of Scotch localities are anything more than *festiva*, I fail to see, whilst, at the same time, I consider that the Shetland race is so far differentiated that it can be at once separated from any forms of *festiva* known. I treat, therefore, all our English and Scotch *festiva* as such, dropping altogether Newman's erroneous use of the name *conflua*, and at the same time treat our Shetland specimens as a distinct sub-species under the name of *conflua*, Tr. Those who have not the Shetland sub-species will of course find it difficult to follow out the intricate muddle that has been woven round this species, but I believe I can safely say that in no part of the mainland of Great Britain has the *conflua* of Treitschke been taken, and, although undoubtedly some of our *festiva* may to a small extent superficially resemble some of the forms of the allied sub-species, there can be no possible doubt in determination. Of the true *conflua* in Iceland, Dr. Mason writes:—"Very abundant and variable; this was first described as a species from Icelandic specimens, and differs from the form usually called *N. festiva* var. *conflua* in British collections from its smaller size; the only British specimens of this form which I have seen were taken by the late John Sang, at Wolsingham in Northumberland" ('Ent. Mo. Mag.,' xxvi., p. 198); whilst we also read:—"The Rev. Dr. Walker exhibited a few *Noctua conflua*, illustrating the varied forms of this species occurring in Iceland; and Dr. Mason said that the only British specimens of *N. conflua* which he had seen resembling the Iceland form of the species were taken at Wolsingham, Durham" ('Trans. Ent. Soc. Lond.,' 1890, p. xxxvii). I believe that these two references apply to the same specimens, although the county is named differently in each by Dr. Mason. It appears, too, that the Wolsingham specimens only "resembled" the Icelandic *conflua*, which is the nearest statement I can make of British (except Shetlandic) specimens. So far, I believe we have never obtained the true *conflua* on the mainland of Great Britain. Concerning the *conflua* from Shetland, Herr Hoffman writes:—"On the authority of Dr. Rössler, I consider *conflua* a var. of *festiva*. I saw eight specimens of *conflua* from the Shetland Isles, which differ as much from the *conua* of Altvater from the mountains of Norway and Lapland, as they vary among themselves, at least in colour. First, the Shetland form has narrower wings, and the fore wings have the apex more pointed, although this is not shown in the figs. in the 'Entomologist,' 1884, plate 1, figs. 8, 9, 10. In colour, they vary from dark grey-brown to reddish-brown and to a reddish-ochreous. In Iceland, according to Staudinger, quite similar forms occur. Dr. Rössler considers *conflua* the mountain form of *festiva*, whilst ova of *conflua*, brought by Dr. Bodemeyer from the Silesian mountains, produced, in Wiesbaden, only *festiva* in all its varieties, but

no *conflua*. Part of these, which came out late in the autumn as a second brood, were found to come nearer to *conflua* than to the typical *festiva* of our flat country. Dr. Rössler has probably tried a large number, and formed his opinion accordingly. Dr. Staudfuss writes to me:—"Dr. Wocke has likewise reared a second brood from Altvater, which, more or less forms an approach to *festiva*." According to Dr. Staudfuss, *festiva* occurs only in the heart of the Riesengebirge, and he found two larvæ at an elevation of 4,000 feet, which produced *festiva*, not differing in the least from the form of the flat country. *Conflua* has never been taken in the Riesengebirge, whilst this form further east on the Schneeberg and Altvater at considerable elevation, seems to represent *festiva*. On the moors of the Upper Hartz, there occurs a small pale form of *festiva*, but I have never found any approaching *conflua* in that locality. Professor Frey gives localities for *festiva*, not only from the lower regions of the Swiss mountains, but also Sils-Maria in the Upper Engadine about 5,500 feet high, and therefore on the borders between the lower and upper Alps; for *conflua*, only the Berner Alps, Belchen, Engenthal and Eigenthal. The last three are at a height of 3,000 feet, and therefore on the boundary between the lower region and mountain region. I only give these details for comparison, to show that *conflua* does not represent unconditionally the mountain form, as *festiva* occurs everywhere in the mountains at the same elevation as *conflua*, even much higher" ('Stett. ent. Zeit.', 1884, pp. 360-362). It would appear certain from this, that Continental entomologists, like ourselves, erroneously call the small specimens of *festiva*—*conflua*, and have not yet differentiated correctly the form known under this name; and it is probable that those from the Alps are simply small *festiva*, like our own moorland forms, but those from Lapland and probably those from Norway are true. It is certain that the var. *borealis* is a true *conflua* variety, for Zetterstedt writes:—"Similar to *N. brunnea*, Fab. or *N. fragariæ*, Bork., but certainly distinct, it is so much smaller, &c." ('Insecta Lapponica,' 941). At the same time, ordinary *festiva* are taken side by side with it in Norway, but these are considered perfectly distinct by Scandinavian lepidopterists (*vide* 'Entom. Tidskrift,' 1885, p. 53). Staudinger writes of *conflua*:—"Perhaps an Alpine and northern variety of *festiva* or a Darwinian species," and gives as localities "Northern Europe, Silesian Mountains, the Alps, Iceland and Labrador" ('Catalog,' p. 83). Of these, the specimens from the Silesian Mountains and the Alps are probably only *conflua*-like vars. of *festiva*, but this is not necessarily so. My friend, Mr. Reid, I know, believes it possible that the higher mountainous districts in Perth and North Scotland might produce the real Shetlandic form, but up to the present time, I have not seen any from the Scotch mainland. With regard to these Scotch *festiva*, which we have been accustomed to call *conflua*, Mr. A. Horne of Aberdeen writes:—"I am now convinced that this variety does not occur in Aberdeenshire, nor, in fact, in any of the northern counties of Scotland. I have taken *N. festiva* in, I think, all the counties from Kincardineshire up to and including Orkney, but they do not appear to be smaller or paler at any one place than another. At Forres, the majority are of a red colour. In Professor Trail's 'List of the Lepidoptera of Dee' (Aberdeenshire) is found the following:—'*N. festiva*, abundant, rather local.' '*N. conflua*, abundant.' I think this is the principal cause of Aberdeen collectors sending away their specimens as *N. conflua*" (*in*

litt.); whilst Mr. Reid, writes:—" *N. festiva* has been sent out as *N. conflua* by many Aberdeen collectors for "exchange" purposes, and the fact that *festiva* never figured in the 'Exchange List' speaks for itself, besides, I have been told by a collector, that 'if we called them *festiva*, we should never get rid of them.' Professor Trail's list, however, has much to answer for in perpetuating the blunder. Although some collectors have worked a great part of the northern counties of Scotland, I do not think the high mountains have ever been worked for *conflua*. I have no doubt, the narrow-winged, unicolorous form occurs freely in such localities. Mr. Tait of Inverurie has a few which he captured in Aberdeenshire. I have taken them myself on some of our high moors, and I have seen others that have been captured high on our hills. I cannot say whether the variety has been captured in the mountains of Perthshire" (*in litt.*). Mr. Maddison writes:—"My specimens of *N. conflua* from Lapland, appear to differ slightly from my Morayshire and other Scotch specimens, in their somewhat paler colour and narrower fore wings, but I cannot say that the difference appears to be much marked" (*in litt.*); whilst Mr. Sydney Webb says:—"If we can claim *conflua* at all, it seems to me that it must be through the Shetland specimens and not through the Aberdeenshire or Perthshire ones. Stress is particularly laid, on the Continent, on the narrow fore wing, and certainly the Shetland specimens possess this in a marked degree" (*in litt.*). The true *festiva* as well as *conflua* occurs in the Shetland Isles.

Noctua, Linn., *festiva*, Hb.

Under this name I include all our British forms except the *conflua* from the Shetland Isles. The variation in ground colour extends from a pale whitish-grey to deep red, and in markings from exceedingly well-developed black quadrate marks between the stigmata and beyond the orbicular, as in figs. 2 and 3 of Newman's 'British Moths,' p. 348, to a total absence of any dark markings whatever. The *conflua*, as figured in 'Newman's 'British Moths,' p. 349, are only small specimens of *festiva* and not the true *conflua* of Treitschke. The species is polymorphic, and it is only possible in the most general way to classify the forms we get. Some of the specimens from northern localities have a strong tendency to develop a glaucous shade, whilst others from exposed localities and moorland districts, have a tendency to be dwarfed in size, although, in our southern woods, there are frequently very small specimens captured. One rarely sees at large, such fine large specimens as some of the North London collectors supply us with for our cabinets, and one only sees occasionally from our southern woods such deep red-brown specimens as are obtained near Perth. The Aberdeen specimens sometimes tend to reddish-brown, but this is of rare occurrence. Hübner's type may be described as follows:—"The anterior wings slaty-grey at the base, the extreme outer margin pale red to the subterminal line, the colour then becomes dark red from this line to midway between the stigmata; the transverse lines grey, the reniform outlined in grey, the orbicular pale pinkish. Hind wings dull grey, fringe red, a dark shade on hind margin, transverse line and dark lunule" ('Sammlung europ. Schmet.' fig. 114). This type has no trace of black markings on the anterior wings. In general variation, we are first struck with the range of colour, which is very great, although not so extensive as in some other species in the same

genus. The great mass of specimens are coloured with whitish-grey, yellow-ochreous or red, extending in some specimens (principally Scotch ones) to bright reddish-brown, of the same shade as in *N. rubi* var. *quadratum* of Hübner, to which such specimens bear more than a superficial resemblance. Two other (almost purely Scotch) forms occur, one, of a deep grey, the other, of a dark purplish-red or plum-colour, the purplish tint being produced as in certain forms of *N. sobrina*, *N. baia*, *Agrotis hyperborea* and many other species. There is another Scotch form, dull reddish-brown in colour, common in the Aberdeenshire districts, which is much darker than any of our more southern forms. In general appearance, too, there is great difference, some specimens are very mottled, others have a distinct dark quadrate spot between the stigmata and another beyond the orbicular, whilst sometimes the basal area (to the central shade) is very pale (grey, ochreous &c.), the outer area being much darker. When the extreme outer margin, beyond the subterminal is also pale, the insect has a banded form, and sometimes this band is most striking in its development. The stigmata vary but little; they are generally pale in colour and well-developed. Only in one specimen of a long series are the two quadrate spots joined by a line under the orbicular, although an occasional specimen shows a tendency that way. There is also considerable difference in the development of the transverse lines, but the only one of these that occasionally presents any striking character, is the median shade, which often stands out conspicuously dark on a pale ground colour. In size there is great variation, and our exposed localities, in the north of England and Scotland, produce the small specimens which Newman erroneously called and figured as *conflua* in his 'British Moths,' p. 349. Hübner's type is a very rare form, and I am indebted to Mr. Wylie of Perth, for perhaps the best specimen I have ever seen of it. It has the basal area to the central shade of a clear bluish or slaty colour, the outer area being of a bright red. Of this type Guénée writes:—"If we only referred to the phrase in the 'Wien.-Verz.,'—'Dunkelrothe und perlfarbige'—and to the position of the species among those Noctuæ 'pupurfarbig,' with *delphinii* and *purpurina*, we should be left in great doubt, but the figure of Hübner, which was perhaps even made from the Thérésien collection itself, which is in fact half purple and half pearly grey, and which represents well, however, our *festiva*, will serve to explain the difficulty" ('Noctuelles,' vol. v., p. 331). This is the most difficult member of the genus to deal with so far as its varieties are concerned, and it is only possible to give the merest rough classification of the forms we get. In coloration (as has been pointed out), the specimens vary from whitish-ochreous to brownish-red and dark grey, and in general appearance, from almost obsolete, to a pale basal half and dark outer half, and from strongly marked quadrate spots between the stigmata and beyond the orbicular to total absence. Some Scotch specimens are pure lilac-grey, as in *Agrotis subrosea* var. *cerulea*. The following is an attempt to classify the various forms:—

A.—Dark purplish or reddish-brown.

- 1.—Without quadrate spots, but having pale base = *festiva*, Hb.
- 2.—Without quadrate spots (mottled form) = var. *congener*, Hb.
(*turbida* by error).
- 3.—With quadrate spots = var. *subrufa*, Haw.

B.—Bright reddish-ochreous (inclining to red-brown).

- 1.—Without quadrate spots, but with pale base (banded form) = var. *rufo-virgata*.
- 2.—Without quadrate spots (mottled form) = var. *conflua*, H.-S.
- 3.—With quadrate spots = var. *mendica*, Fab.

C.—Pale yellow or whitish-ochreous.

- 1.—Without quadrate spots, but with pale base = var. *ochrea-virgata*.
- 2.—Without quadrate spots (mottled form) = var. *ignicola*, H.-S.
- 3.—With quadrate spots = var. *primulæ*, Esp.

A.—Ground colour deep purplish-red.

a. var. congener, Hb.—This is the nearest approach to the type, but instead of having a pale slaty-coloured base, the purplish or red-brown colour is spread over the whole wing (basal area included), whilst the pale stigmata &c., give it a mottled appearance. Of Hübner's figure ('Sammlung europ. Schmet.', fig. 617), I wrote:—"This is a very red form, with almost unicolorous stigmata." Guenée writes:—"This is of a deeper and more intense red, above all in the median area, with the transverse lines well marked" ('Noctuelles,' vol. v., p. 331).

β. var. subrufa, Haw.—The ground colour deep purplish-red or red-brown, with the basal area slightly slaty or glaucous as in the type, to the central transverse shade, which is darker and generally well developed; the stigmata, well developed, pale greyish-ochreous, with a dark quadrate spot between the stigmata and one beyond the orbicular; the area between the elbowed and subterminal lines, which are ochreous in tint, being much darker; a small ochreous cloud sometimes round the reniform. One of my specimens of this form from Warrington, has the two quadrate spots joined by a black line under the orbicular, as is frequently the case in the allied species *ditrapezium*, *c-nigrum* &c., whilst another has the complete transverse line, black, and joining the inner quadrate spot, and also the elbowed line edged internally with darker, joining the outside of the reniform, giving it a peculiar appearance. My specimens of this variety have come from Aberdeen, Pitcaple, Perth and Warrington. This is the *subrufa* of Haworth, whose diagnosis is as follows:—"Noctua alis rufis vel rufo-purpureis, strigis ordinariis stigmatibusque pallidioribus." "Præcedenti (*festiva*) valde affinis, at alæ in mare magis rufæ, characteribus omnibus obscurioribus, stigma reniforme dorso, maculæ oblongæ fuscæ adnatum. Fæmina purpurascit, stigmatè postico superne flavicante. Cætera ut in *N. festiva*" ('Lepidoptera Britannica,' p. 227). Of this variety Guenée writes:—"With no black marks before and beyond the ordinary stigmata" ('Noctuelles,' vol. v., p. 331); whilst Humphrey and Westwood write:—"The var. *subrufa* of Haworth, differs in having the fore wings of the male redder-coloured, with the markings less conspicuous" ('British Moths,' p. 131).

B.—Ground colour, bright reddish-ochreous.

a. var. conflua, H.-S.—Anterior wings deep reddish-ochreous, mottled with darker red markings; an incomplete, followed by a complete basal line with a tiny black dot often placed between them on the median nervure, dark reddish quadrate spot hardly traceable between

the pale stigmata, but sometimes produced into a transverse shade; the paler elbowed line edged with darker; the subterminal line pale; the space between the latter and elbowed line darker, and frequently mottled with transverse rows of minute dots. My specimens are from Chattenden (Kent), Rannoch and Perth. This var. I certainly believe to be the *conflua* of Herrich-Schäffer, who says that his *conflua* is larger and broader winged than *festiva*, which is exactly the opposite to what is really the case with true *conflua*. It is marvellous how much like bright specimens of *N. rubi*, some of these vars. of *festiva* really are. The *conflua* of Herrich-Schäffer would appear to be a reddish-ochreous almost brownish-ochreous form of *festiva*, for he writes:—"Often larger, with broader fore wings and brighter ochreous and reddish-brown mixture." "*Fusco-testacea, umbra media et area tertia ante lineam undulatam versus marginem anteriorem ferrugineis.*" "It comes very near *bella* (*rubi*), but the pectinated antennæ of the male leave no doubt as to the specific difference. The fore wings increase in width towards the outer margin, which is especially noticeable in the female, where the margin appears more wavy and the apex much more acute. The colour does not approach violet-red so much, but is more yellow-brown. Between the two basal lines (abbreviated and complete) is a black dot. The outer subterminal line runs somewhat obliquely towards the inner margin. Of the claviform, only the black dot at the end is visible" ('Systematische Bearbeitung' &c., Supp., p. 358).

β. var. rufo-virgata, mihi.—With the ground colour of the anterior wings as in the last, but with the basal area paler ochreous, and also the extreme outer margin beyond the subterminal line, the area between the central transverse shade and the subterminal line being darker red, and forming a sort of transverse band. My specimens of this form have come from Perth, Liverpool and Chattenden.

γ. var. mendica, Fab.—As in the previous vars, but with two dark quadrate spots, sometimes almost black, but generally dark red, one between the stigmata, the other beyond the orbicular. Fabricius' diagnosis is:—"Noctua cristata, alis deflexis pallida incarnatis; macula media fusca stigmatibus flavis" ('Mantissa,' p. 168, No. 221). My specimens have come from Hampstead, Farnboro' (Kent), Carlisle, Perth, Pitcaple, Chattenden and Shooter's Hill Woods. This is *festiva* var. *β* of Haworth, who writes:—"Alis magis ferrugineis basin versus minus pallidis, strigis ordinariis posticis distinctioribus, macula atra jam trigona, jam subrhombea ante, alteraque quadrata inter stigmata; alis posticis fere fuscis striga pone medium saturatiore; cæteris ut in *a*" ('Lepidoptera Britannica,' p. 227).

C.—Ground colour yellow-ochreous.

a. var. ignicola, H.-S.—Anterior wings yellow-ochreous, with the transverse lines fuscous; the stigmata pale, with only the faintest traces of a darker central transverse shade and dark coloration between them, the elbowed and subterminal lines edged externally with darker. I have specimens from Aberdeen, Chattenden and Hampstead. This is one of the commonest forms of *festiva*. Herrich-Schäffer's figure is a small one, more like some of the moorland specimens than our larger southern forms. It is of a pale yellowish colour, with a slight reddish tinge between the central shade and subterminal line" ('Systematische Bearbeitung,' fig. 455).

β. var. ochrea-virgata, mihi.—Like above in ground colour, but with the central shade well-developed, and the area extending from this to the subterminal line filled in with dark reddish, through which passes the paler elbowed line, and in which stands the paler orbicular. Some of these banded forms are very strongly marked. My specimens have come from Farnboro', Chattenden and Shooter's Hill, all Kent localities. A sub-variety of this has only the transverse central shade developed, and then the appearance is most striking. I have specimens from Chattenden and Hampstead.

γ. var. primulae, Esp.—Like the above, but with dark quadrate spots. I have specimens from Chattenden, Carlisle, Perth, Moray and Aberdeen. This is the *primulae* of Esper, which may be thus described:—"Anterior wings pale ochreous-yellow, with a distinct, blackish quadrate spot between the stigmata, and another beyond the orbicular, which is continued as a wedge-shaped mark towards the base. There is a distinct transverse basal line and a fuscous shade between the elbowed and subterminal lines" ('Die Schmet. in Abbildungen' &c., pl. 136, fig. 5). Fig. 6 is rather greyer. Esper's diagnosis is as follows:—"Alis griseis, superioribus nebuloso-fasciatis, stigmatibus ordinariis albidis, maculis intermediis rhomboideis nigris." "Reddish-grey, with transverse line brown and the stigmata whitish" (*l.c.*, p. 428).

Besides the above the following are very distinct and worthy of description:—

α. var. grisea, mihi.—Anterior wings almost unicolorous dark greyish, slightly glaucous, with slight reddish tint, a most ill-developed or obsolete central shade, orbicular grey, reniform ochreous, slightly darker transverse shade between the elbowed and subterminal lines. My specimens have come from Aberdeen.

β. var. cærulea, mihi.—The anterior wings of a clear slaty or lilac colour. The stigmata paler, but without quadrate spots. A sub-var. *quadrata* has the same pale lilac ground colour, but the space between the stigmata filled in with a dark quadrate spot, with another inside the orbicular. I have only seen specimens from Aberdeenshire.

Noctua, Linn., *conflua*, Tr. (sub-species).

The narrow and more pointed forewings of the Shetland specimens known by the above name, as well as the difference in tint from any form of *festiva*, at once single this out as distinct from the latter species. The line of demarcation between this and *festiva* is as clearly definable as that between many other species generally recognised as distinct. Treitschke's description of the type is as follows:—"Apamea conflua. A. alis anticis hepaticis, maculis ordinariis pallidioribus, strigis obsoletis confluentibus." "*Conflua* is not much larger than *Ap. strigilis*. The fore wings are liver-coloured, marbled more or less with yellowish, or reddish-brown. It is more ochreous on the outer margin and around the paler stigmata. Of the basal transverse line only a blackish dot is visible; the orbicular is very large and pale, whilst in the position of the end of the claviform is a small black spot. The reniform is large, whilst, between the stigmata and beyond the orbicular, are dark quadrate and triangular marks. Before the paler fringe is a pale wavy transverse line, followed by a dark brown band. The hind wings have a pale ochreous ground colour, with a darker lunule and pale yellowish fringe" ('Die Schmet.' &c., vol. v., Pt. 1, p. 405). Most of the specimens of *conflua* have a deep brownish coloration, some being more ochre-

ous, and others red, the latter tint often being distinctly observable in the central area. It is rare that the ground colour is entirely red, but I have such specimens in my series. Compared with the polymorphic *festiva*, this is a constant species, but still it varies considerably within narrow limits. The red-brown form, as described above, is the type, the commoner grey-brown form is the *borealis* of Zetterstedt, whilst there is another most striking form, greyish-brown in colour as in *borealis*, but without the dark quadrate spot. I am doubtful whether Zetterstedt's *diducta*, which he compares with *Cerastis rubiginea*, is a var. of *conflua*, but, as it is treated as such by recent Scandinavian authors, I have given Zetterstedt's description. There is some doubt whether Guenée, like Newman, simply looked upon small *festiva* as *conflua*, for he writes:—"It is always very rare. I believe that it is found in the environs of Paris, for in M. Boisduval's collection there is a specimen mixed with his *festiva*, and which he, no doubt, reared with them" ('Noctuelles,' vol. v., p. 332). Boisduval's fig. 3 ('Icones,' Plate 83) is a real Icelandic-looking *conflua*, with "dark inner and outer margin, central and costal areas slightly ochreous, pale stigmata, and dark red quadrate spot between them."

α. var. borealis, Zett.—The greyish-brown form of *conflua* is thus described by Zetterstedt:—"Alis anticis brunnescenti griseis, maculis ordinariis dilutioribus interstitio nigro-brunneo, strigaeque intra marginem posticum pallida; posticis fusco-griseis. ♂. (Long. al. exp. $1\frac{1}{8}$ poll.) *Noctua borealis* Dalm. 'in litt.'" "Hab. in Lapponia. Mus. D. Schönherri, e quo mihi ad huic Faunæ inserendam missa (Lapponia borealis)." "Similis *Noct. brunneæ*, Fabr., Treits., Hübn. f. 121, seu *N. fragariæ*, Borkh.; sed certe distincta. Multo minor, alæ anticæ ad costam minime flavo-maculatæ, ut in *brunnea*, et posticæ griseæ unicolores, nec fascia ad marginem posticum fusca. Alæ anticæ fusco-grisescens, maculis ordinariis pallidioribus, interstitio inter illas macula triangulari obscure brunnea toto repleto, et macula ejusdem coloris ac fere formæ juxta maculam ordinariam interiorem versus basin. Striga postica tenuis pallida, vix undulata. In ipso summo margine puncta minutissima fusca. Obs. Hanc et sequentes species *Hadena* amandavi, quoniam, ut mihi videtur, majorem cum hoc genere quam cum aliis habent affinitatem. Dubius tamen inserui" ('Insecta Lapponica,' 941).

β. var. obsoleta, mihi.—Like var. *borealis*, but somewhat paler in ground colour and without the dark quadrate spot between the stigmata. Anterior wings grey-brown, the stigmata still paler, the transverse lines &c., as in var. *borealis*. This form appears to be comparatively rare, at any rate it is badly represented in my series from Shetland.

γ. var. diducta, Zett.—This var. is thus described by Zetterstedt:—"Cerastis diducta: alis subnitidis griseis, anticis fascia latissima ferrugineo-testacea, punctis costalibus pallidis, maculis ordinariis obsoletis. ♂." "Habitat in Lapponia." It is then compared with *C. rubiginea*. Of *diducta* we read:—"Framvingarne grågulatiga, med otydliga teckningar, pyramidalfläcken knappast märkbar. Typ ex å Svenska Riksmusei entomologiska afdelning, Tillsammans med föregående" ('Entomologisk Tidskrift, 1885, p. 53).

Noctua, Linn., *rubi*, View.

The type of this species is thus described by Vieweg:—"Of the size of *Noctua* (*Hadena*) *pisi*. The ground colour of the fore wings is

a reddish cinnamon-brown. Near the hind margin runs a nearly obsolete, somewhat lighter, transverse line. In the centre of the wing are an orbicular and a reniform stigma, whilst between them is a dark brown quadrate spot; the stigmata are of a brownish-grey colour; beneath the orbicular lies a small, black, triangular spot outlined in pale. A few grey dots are on the costa near the apex. The hind wings are light grey, their hind margin light reddish-brown" ('Tabel-larisches Verzeichniss,' p. 57, No. 86). Of this species we appear to get two forms, the darker reddish-brown form = the type, and a pale brighter red form = *quadratum*, Hb. Mr. Walker also records the capture of a "bright yellow" variety, in the 'Entomologist's Record,' vol. ii., p. 184, taken near York. Guenée writes:—"It is very subject to variation, and it is because they have not recognised the species, that different authors have given it so many names; but there is no fixity in its modifications" ('Noctuelles,' v., p. 334). In England, on the contrary, there is very little variation except in depth of ground colour, the darkest specimens being somewhat suffused, the brightest being quite red in colour. This coloration in England becomes almost seasonally dimorphic, the greater number of specimens in the spring or early summer brood being bright red, those of the autumn brood being dark; but dark specimens sometimes occur in the spring brood and bright red ones in the autumn brood.

a. var. quadratum, Hb.—The bright red form of *rubi* is the *quadratum* of Hübner. "The anterior wings are bright red in colour, the basal, elbowed and subterminal transverse lines are all pale, edged with darker; the reniform and the outer edge of the orbicular are outlined in ochreous, whilst the dark red quadrate spot between the stigmata is also edged with ochreous. Hind wings grey, reddish on the hind margin" ('Sammlung europ. Schmet.,' fig. 477). This red form is captured in all localities with the darker type.

Noctua, Linn., *umbrosa*, Hb.

This is one of the most constant species in the genus, a little difference in depth of ground colour, and in the intensity of the central transverse shade being all that is noticeable in a very long series, so far as colour is concerned. The females show a tendency to be smaller than the males, but this is not always so, some of the females being of full size. Hübner shows this size distinction in the sexes, his fig. 457, the ♀, being smaller than 456, the ♂. Hübner's type figure may be thus described:—"♂. Anterior wings reddish-brown (like our British specimens), with an abbreviated, followed by a complete black basal line; the stigma outlined in blackish-brown, the outer edge of claviform also similarly outlined, a dark transverse shade from costa to inner margin passes between the stigmata; the elbowed line fine and dark, the subterminal dark red-brown. Posterior wings ochreous, hind margin darker, with a still darker line parallel to hind margin." "♀. The same colour as fig. 456, with the same markings, but smaller in size" ('Sammlung europ. Schmet.,' figs. 456-457).

Noctua, Linn., *xantographa* (*xanthographa*), Fab.

This is a most variable species in ground colour and in the character of the stigmata. The ground colour varies from the palest grey to black and deep red, and, whilst the stigmata are frequently unicolor-

ous with the rest of the wing, they sometimes stand out conspicuously pale, even in the darkest specimens. Newman writes:—"The colour is grey-brown, tinged either with ochreous-brown, brickdust-red or umber-brown; the discoidal spots are generally very distinct and decidedly paler, being of an ochreous-grey tint; in some, the median area is exactly concolorous with the general area of the wing. The hind wings are pale grey-brown, with a dark brown hind-marginal band; the fringe is paler" ('British Moths,' p. 354); whilst Guenée says:—"It varies from the deepest brick-red, to the palest, and in another direction to the most intense black-brown, but all the varieties are linked together, and are not able to be separated into races" ('Noctuelles,' vol. v., p. 337). Herr Hoffmann writes:—"Through the kindness of Dr. Staudinger, I have received this species from different localities, among them I have a pair, light grey with yellow shading, from Sicily. Although I have a large number of varieties in my collection, I do not find any approaching the Shetland form, the fore wings of which are largely scaled and show a deep black-brown with a reddish tint, the reniform and orbicular being ochreous. Mr. McArthur writes, that he caught still darker ones" ('Stettiner ent. Zeitung,' 1884, p. 360). It would be impossible to classify all the varieties of this species, but most of them may be included in one of the following six groups:—

- 1.—Pale greyish = var. *cohæsa*, H.-S.
- 2.—Dark greyish-fuscous = *xantographa*, Fab.
- 3.—Pale reddish-grey or pale reddish = var. *rufescens*.
- 4.—Bright red = var. *rufa*.
- 5.—Dark reddish-black = var. *obscura*.
- 6.—Blackish-grey = var. *nigra*.

The variation in the development of the stigmata and the distinctness of the central shade and transverse lines might be multiplied indefinitely. In the three paler forms, the stigmata are generally distinct though variable in colour, but in the three darker forms, they are frequently quite absorbed in the ground colour, and the fore wings become, in the darkest Scotch specimens, unicolorous without any trace whatever of paler or darker lines and markings. The Fabrician description of the type is as follows:—"Xantographa. N. cristata alis deflexis testaceis; maculis ordinariis flavis." "Statura omnino præcedentis (*oleracea*) at paullo minor. Caput, thorax, alæ anticæ obscure testaceæ maculis ordinariis flavescentibus, postice striga punctorum nigrorum. Posticæ uti et abdomen cinereæ" ('Mantissa,' p. 170). There is a considerable amount of variation in the depth of colour in the hind wings, those of the males being usually (though not always) paler than those of the females. The Shetland forms, previously referred to by Herr Hoffmann, are identical with those from Scotland, and I have seen no dark forms from the former localities, that I have not received from the Aberdeenshire collectors. Fabricius spells the name *xantographa*, although *xanthographa* is the more correct method of spelling.

a. var. *cohæsa*, H.-S.—Herrich-Schäffer's description of this pale form of *xantographa* is as follows:—"Ochracea-grisea, linea undulata pallidiore, in fæmina basin versus maculis sagittatis nigris." "Like *xanthographa* but smaller and plumper. Colour of a clear yellow-grey. Markings almost exactly as in *xanthographa*; stigmata pale and clearly defined" ('Systematische Bearbeitung' &c., p. 209). This pale greyish

or greyish-ochreous form, is one of the commonest varieties in the South of England, but becomes rarer in Scotland, where the darker varieties take the place of the paler ones. Of this variety Staudinger writes:—"Dilutior, grisescens" ('Catalog,' p. 83).

β. var. *rufescens*, mihi.—Under this name I would include all those pale reddish forms which are not of the decided red colour of var. *rufa*, but which have the red coloration more pronounced than the pale grey of var. *cohæsa*, or the dark grey of the type. A very large per-centage of our southern forms are of this character, and it is generally the palest form obtained in Scotch localities where the very pale grey form is almost unknown. The markings are generally as distinct as in the type and var. *cohæsa*, and the stigmata are generally well marked.

γ. var. *rufa*, mihi.—Dark red varieties inclining to chestnut colour, are occasionally met with in the South of England, and become common in Scotland. There are specimens with distinct, clearly-marked stigmata, but generally more indistinct transverse lines, whilst other specimens have the stigmata and transverse lines quite obsolete (*obsoleta-rufa*) and the form then becomes unicolorous. All these bright red forms I would include under the name *rufa*.

δ. var. *obscura*, mihi.—The anterior wings of a deep reddish-black, with the markings ill-defined, but the stigmata clear and well marked. The posterior wings deep blackish-grey. A great many of the specimens of var. *obscura* have the stigmata and transverse lines quite obsolete and merged into the ground colour (*obsoleta-obscura*). I have seen no specimens of this form from the South of England, but they are not rare in the Northern counties, and become common in Scotland. Writing of 'The Lepidoptera of Unst,' Mr. J. Jenner Weir remarks:—"The specimens are mostly very dark, some with the distinct yellow spots, from which the name is derived; and in others the reniform and orbicular stigmata are almost obsolete" ('Entomologist,' vol. xvii., p. 2).

ε. var. *nigra*, mihi.—Just as vars. *rufescens* and *rufa* develop an intensely dark reddish-black form (var. *obscura*), so var. *cohæsa* and the type have a greyish-black form, as intensely black as, but without the red tinge of var. *obscura*. As in the latter variety, some specimens have distinct stigmata, whilst others have them obliterated, and a perfectly unicolorous form is produced (*obsoleta-nigra*). I have only seen Scotch specimens of this variety.

Noctua, Linn., *plecta*, Linn.

This is another Linnæan species, which was described as follows:—"Ph. *Noctua plecta*, spirilinguis subcristata, alis brunneis linea nigra margineque crassiore albedo." "Media sed minor. Alæ superiores brunneæ, margo crassior a thorace fere ad apicem albidus; linea nigra a thorace per maculas ordinarias ducta distinguit alam brunneam a margine albo; postice margo exterior punctis tribus, albis minutissimis. Subtus alæ superiores margine postico rufescentes. Alæ inferiores albidæ, puncto subtus nigro" ('Fauna Suecicæ,' p. 321). There are two forms of this species, one, red-brown, the other, violet-brown in colour. The former is the type, the latter is var. *anderssoni*, a variety described from Scandinavia. The red form appears to be the most common throughout Britain. Guenée writes:—"The specimens from North America do not differ in any way from those of Europe"

(‘Noctuelles,’ vol. v., p. 326). The pale costa stands out very conspicuously, and gives the species quite a character of its own. The stigmata, too, are usually of the same pale shade as the costa, and slight variations in the shape of the orbicular, and in the way it joins the costal streak, give rise to peculiar forms. Sometimes, however, the stigmata merge into the ground colour, the orbicular being especially liable in this respect. The extreme form produced by the obliteration of the orbicular would appear to be the *unimacula* of Staudinger.

a. var. *anderssoni*, Lampa.—The violet-brown variety of this species is described under this name as follows:—“Framvingarne märkt violettblå, nästan violettsvarta, blott främre medianstammen vid basen samt de båda fläckarnes kanter hvitgulaktiga.—Sverige; Dalarne; Säterdalen; flera ex. funna af Andersson” (‘Entomologisk Tidskrift,’ 1885, p. 54).

? β. var. *unimacula*, Stdgr.—Under this name Staudinger adds a doubtful variety of this species in the ‘Stett. ent. Zeit.,’ 1859, p. 213, which is without an orbicular stigma. In his ‘Catalog,’ p. 84, he writes:—“Macula orbiculari nulla.” There is considerable variation in the development of the orbicular. I have two specimens in my series with only the faintest trace of orbicular stigmata; one so far obliterated, that it may be looked upon as obsolete.

Noctua, Linn., *flammatra*, Fab.

The type of this, one of our rarest British NOCTUÆ, is thus described by Fabricius:—“*Noctua cristata alis incumbentibus griseis: linea flexuosa baseos nigra, thorace fascia atra.*” “Affinis *N. exclamationis*. Corpus cinereum fascia lata abbreviata thoracis atra. Alæ anticæ griseæ linea magna baseos flexuosa atra. In medio maculæ ordinariæ macula fusca distinctæ” (‘Mantissa,’ p. 155, No. 147). Guenée adds a var. A from Brazil, and writes of it:—“Much larger (it attains almost 55 mm.), but does not differ otherwise from European examples” (‘Noctuelles,’ vol. v., p. 328).

5. Family:—*Orthosidæ*, Gn.

This family of the NOCTUÆ appears to exhibit no very strong affinities between some of its constituent genera, and yet to a great extent others of them are closely allied. Dr. Staudinger places it between the *Caradrinidæ* and *Xylinidæ*, but there is little doubt that the affinities of some of the group are rather with *Agrotis* (in the broader acceptation of the term). Among its genera, *Pachnobia* is especially closely allied to *Hadena* or *Mamestra*, and Dr. Chapman has suggested (‘Ent. Record’ &c., vol. ii., p. 12) the removal of the two British members of the genus from their present location altogether. *Tæniocampa* is an excessively variable genus, and contains some of the most polymorphic of the whole of the NOCTUÆ—*gothica*, *instabilis*, and, to a lesser extent, *stabilis* and *munda* are striking examples. Of the two *Dyschoristæ*, *suspecta* is exceptionally variable, whilst *Anchocelis pistacina* also varies endlessly. The beauty of the *Xanthiæ* and their close allies does not prevent *X. fulvago* and *aurago* being excessively variable, and *Orrhodia* (*Cerastis*) *vaccinii* and *ligula* (*spadicea*) are not at all satisfactorily determined in their different forms of variation. There is no striking general tendency to variation in the direction of melanism in the family, but some few species are frequently melanic. The tendency is most noticeable in *Tæniocampa*. Sexual demorphism is occasionally

exhibited, but neither is there any striking general development in this direction.

Panolis, Hb. (*Trachea*, Och.), *piniperda*, Panz.

This species varies considerably in ground colour, which extends from a pale whitish-grey to a brilliant red. Some of the grey forms are tinged with green, a not uncommon form of variation in other species, *Smerinthus tilix* and *Ellopia fasciaria* being well-known examples. The Rev. Bernard Smith sent me a specimen of *piniperda* which had come from Perth, of a deep mahogany-brown ground colour, with the central band darker, the stigmata joined at their bases by a fine white line, the orbicular being white and the reniform ochreous but outlined in white. I have seen no other like it. The species is known in Scandinavia as *griseo-variegata*, Göze, an earlier name, but *piniperda* is so well-known that it seems a pity to replace it. Guenée gives two forms, the red and the grey, but there is a great difference in the intensity of the red, the extreme forms being very brightly coloured, and agreeing with the brilliantly tinted *flammea* of Hübner. There is considerable variation in the colour of the stigmata, which are sometimes white, sometimes ochreous, sometimes reddish surrounded by ochreous. The pale central nervure reminds one of certain *Agrotidæ*, but the most striking character is the variation in the shape of the reniform, which sometimes assumes strange forms, and varies also in position. Guenée is right in considering as the type the ordinary red and grey form. He writes of it:—"Superior wings of a bright brick-red colour, with the nervures and some of the scales of a greyish-white, with olive or ochreous clouds, chiefly on the median and terminal spaces; a narrow band of a dirty lilac colour, slightly shiny, follows the elbowed line, which is strongly toothed and closely approaches the complete basal line at the inner margin, the discoidals are clearly marked, white, shaded with olive interiorly; the reniform very large, oblique and drawn out, the orbicular small and round. The inferior wings of a blackish colour, reddish in the basal area, with a lunule and transverse line darker" ('Noctuelles,' vol. v., p. 340). The *spretæ* of Fabricius is also the type. His diagnosis is:—"Bombyx alis deflexis carneo luteoque variis: stigmatibus albis" ('Mantissa,' p. 124). He then quotes Panzer's original type description as follows:—"Phalæna *piniperda* spirilinguis cristata, alis deflexis: superioribus rubicundo luteo variis, macula transversali albidiori dolabriformi; inferioribus griseis pallidius fimbriatis" (Panzer, 'Monograph,' 51, Plate 1., figs. 1-12). Of the imago of this species Dr. Chapman writes:—"Trachea *piniperda* is much nearer to *Tæniocampa* than is *Pachnobia*, the eggs are laid in groups, the moth sits with deflexed wings. Indeed it seems to be a true *Tæniocampa*, somewhat modified in colouring to suit its especial food; the striping of the larva being like that of *gothica* or *instabilis*, and the markings of the moth being those of a *Tæniocampa*, but the colouring is such as to harmonise with the rich tints of the bark of the smaller branches of Scotch fir and the shadows of the pine needles" ('Entomologist's Record' &c. vol. ii., p. 12).

a. var. flammea, Hb.—This is the extreme red form of *piniperda*, and Hübner's figure is very brightly coloured. "The anterior wings have the extreme base yellow, followed by an abbreviated, transverse, black basal line, then a bright red patch followed by another basal

line pale yellowish in colour. The orbicular and reniform both yellowish, outlined in white; the extreme costal area above the stigmata dark plum-colour, the space below the same bright red, the肘ed and subterminal lines whitish, the space between them red, the space beyond the subterminal grey, fringes yellow, all the nervures white and distinct. Hind wings dark grey, outer edge pinkish" ('Sammlung europ. Schmet.,' fig. 91).

β. var. grisea, mihi.—I am not certain whether this is Göze's type of *griseo-variegata*, but it is undoubtedly the var. *A* of Guenée, who writes:—"The red colour almost completely disappears, and is replaced by greenish-grey, the stigmata also shaded slightly inside with the same colour" ('Noctuelles,' vol. v., p. 340). He also adds that "the variety is found in the same localities as the type, but more especially in Lapland." In England a fair proportion of our specimens are of this grey variety. I have it from several English and Scotch localities.

Pachnobia, Gn.

This genus was created by Guenée for *carnea*, *hyperborea*, *carnica* and *glacialis*, the two latter having since been proved vars. of *hyperborea*, which species has, I believe, very properly been referred to *Agrotis*. Staudinger removed *leucographa* and *rubricosa* into the genus with *carnea*, and it is only in this restricted sense that we use the genus. Our two British species, which appear to have no very close relation, are subject to a fair amount of variation, *rubricosa* being, like so many species, normally red in our more southern localities, quite slaty in the more northern ones. I am almost entirely indebted to Dr. T. A. Chapman for my knowledge of some of the species in *Pachnobia* and *Teniacampa*.

Pachnobia, Gn., *leucographa*, Hb.

I have a very long series of this beautiful species, thanks to Dr. Chapman. The characteristic red colour of this species varies considerably in intensity, sometimes being bright and tending almost to ochreous (= var. *rufa*), at others, tending to blackish. There is also a great deal of variation in the colour, development and position of the stigmata, frequently these are of a bright yellow colour, whilst occasionally, they are of the ground colour and exhibit no special development, and are, in fact, practically obsolete. The 8-shaped reniform, where the upper and lower parts are filled in with darker, with an ochreous outline, appears to be by far the commonest form. The type is figured by Hübner, and has the "anterior wings of a dull reddish colour, with a much paler (pinkish) appearance on the outer part of the wing beyond the elbowed line; a grey shade on costa just above the stigmata; a black transverse basal line; the stigmata outlined in yellowish; a costal streak above the orbicular; a black shade from the costa to the reniform which is continued from the reniform to the inner margin; elbowed line wavy, subterminal line from apex to anal angle distinct, the outer area beyond the subterminal line very dark. Hind wings pale grey with a pinkish tinge, the hind margin dark, with a pale line running through it, distinct lunule" ('Sammlung europ. Schmet.,' fig. 411). His fig. 572 in the same work, is of a much darker red colour. The form with the pale shade running from the apex to the inner margin is a very characteristic one. The more unicolorous red-brown form—without the pale shade from the costa to the inner margin just beyond the elbowed line, which cha-

racterises the type—is the *lepetitii* of Boisduval. The different forms—dark blackish-red = *suffusa*, red-brown = *lepetitii*, Bois. (and *leucographa*, Hb.), and bright pale red, almost reddish-ochreous = *rufa*—all present *inter se*, a certain amount of variation in the more complete development or absence of the ochreous colour in the stigmata. In minor points of variation, the orbicular varies from a dot or even complete absence, to a large well marked oval or ochreous spot (I have one specimen in which it is especially long and yellow). The dark central shade also varies a great deal in intensity, the extreme development in this direction producing var. *suffusa*. The pale transverse shade between the elbowed and subterminal lines and the variation in the reniform stigma, have already been alluded to. The rich purplish tint in some specimens is very noticeable.

a. var. lepetitii, Bois.—This is the red-brown form of *leucographa*, closely allied to the type, but with no trace of ochreous in the stigmata. The description I made of Boisduval's figure ('Icones,' Pl. 83, fig. 2) is as follows:—"Anterior wings dull reddish-brown with a complete transverse, blackish basal line; the reniform and orbicular stigmata outlined in darker; the elbowed line black and touching the reniform; median shade still darker than the rest of the wing, but not strongly developed; the area directly beyond the subterminal line very dark. The hind wings pale with a dark lunule." This form, compared with the type is very rare, judging from the large numbers of specimens received from Dr. Chapman. I have only some half dozen specimens in my long series.

β. var. suffusa, mihi.—This is an extreme variety, the dark central shade spreading over and intensifying the colour of the anterior wings, making them of a deep blackish-red tint. These dark forms vary much in the development of the stigmata, some of the specimens having them as yellow and well-developed as the type, others having them as obsolete as var. *lepetitii*. I would include all the dark forms under this varietal name.

γ. var. rufa, mihi.—Perhaps the prettiest form of this species (and most certainly in Britain the rarest) is that in which the ground colour is of a bright red, of a much paler tint than in the type. It would also appear to be very rare, judging from the few specimens I have been able to select from the large number sent me by Dr. Chapman. These beautiful pale, almost ochreous-red forms, generally have well-marked, distinct, ochreous stigmata. This is so in the specimens I possess. I have only seen the form from Hereford.

Pachnobia, Gn., *rubricosa*, Fab.

This widely distributed and common species in Britain, exhibits a range of colour variation parallel to that of *Agrotis hyperborea* and *A. subrosea*, varying from the deepest red to a clear slaty, the latter form gradually becoming more common in Scotland and the more northern English localities. The type of this variable species is thus described by Fabricius:—"Noctua cristata, alis deflexis fusciscentibus: costa alba fusco maculata, apice fusca: punctis albis." "Alæ anticæ fusciscentes, cinereo undatæ margine tenuiori baseos rufescente. Costa ultra medium albida maculis tribus nigris apice fusca punctis parvis duobus albis. Subtus obscuræ" ('Mantissa,' p. 176). Although subject to so much minor variation, the different specimens may generally be grouped under one of the following:—

- 1.—Pale reddish-grey = var. *pallida*.
- 2.—Bright red = var. *rufa*, Haw.
- 3.—Reddish-brown = *rubricosa*, Fab.
- 3a.—Reddish-brown, with slaty costa and transverse lines = var. *mista*, Hb.
- 4.—Dull purplish, with slaty tinge = var. *mucida*, Esp.
- 5.—Slaty-grey = var. *pilicornis*, Brahm.

Guenée writes:—"I consider as the type, those individuals which have the grey colour predominating and mixed with violet, and in which the hind wings are dark grey" ('Noctuelles,' vol. v., p. 350). This is an error, as the Fabrician type is not grey, but red-brown. The dark red-brown type reaches as far north as Morpeth. I have also specimens from Droylesden, Hereford and Brentwood (Essex). In the minor points of variation in this species, we notice that the stigmata, although always indistinct, are much better developed in some specimens than others, especially in the case of the orbicular. The transverse lines, too, are frequently obsolete and generally ill-defined, but sometimes stand out in clear grey and become quite conspicuous. This is especially the case in those forms in which the pale colour is developed more than the ground colour. Except in colour, however, it is rare that one gets any striking modification.

a. var. pallida, mihi.—The anterior wings of a pale greyish-red tint, being much whiter in general appearance than the strongly coloured var. *rufa*. This must be looked upon as a very pale form of var. *pilicornis*, and is more especially restricted, although not confined, to northern localities. My specimens have come from Killarney, Morpeth, Darlington, Hereford and Ely.

β. var. rufa, Haw.—The red variety of this species is thus described:—"Noctua alis rufis, costa usque ad medium pallidiore, strigis quatuor undulatis stigmatibusque ordinariis obsoletiusculis; posticis fusco-rufescentibus ciliis rufis" ('Lepidoptera Britannica,' p. 232). Of this variety Guenée writes:—"Smaller, of a clear red, with all the lines well-marked in clear ashy-grey. Inferior wings unicolorous, fringe red, as in the type" ('Noctuelles,' vol. v., p. 350). Guenée, it will be seen, has extended Haworth's description considerably. Staudinger simply writes of it:—"Al. ant. rufis" ('Catalog,' p. 114). In the south of England, this is one of the most common forms of the species, rare as it is in our northern British localities. In the midland and north-eastern counties of England, the form is comparatively rare. I have a fine series of this form from the south-eastern counties and Hereford. It leads up to the dark reddish-brown type form, which is also abundant in the same districts, and reaches as far north as Morpeth. There is generally a total absence of distinguishable transverse strigæ in this variety, as there is also in the type, owing to the fact that they are essentially unicolorous forms. This is especially noted in Haworth's description, but that of Guenée is very misleading in this respect.

γ. var. mista, Hb.—The *mista* of Hübner has "the anterior wings of a dark reddish-brown with a slaty-grey costa. There is a transverse slaty-grey basal streak, a faintly-marked orbicular followed by a transverse red shade, and an almost obsolete reniform; the elbowed and subterminal lines slaty-grey, the outer margin also slaty-grey. Hind wings very dark grey, slightly paler at base" ('Sammlung euro-

päischer Schmet.,' fig. 519). Of *mista*, Guenée writes:—"Of a deep brick-red, with the costa and the transverse lines tinted with grey, and the terminal space darker. Inferior wings darker on the outer margin, with a median line sometimes visible" ('Noctuelles,' vol. v., p. 350). My specimens of this variety have come principally from Darlington and Hereford. It is the most common form in the former locality, but, in the latter, it appears to be the most extreme form, and the nearest approach to the more purple-grey forms peculiar to North Britain.

δ. var. *mucida*, Esp.—Esper's diagnosis of this variety is as follows:—"Alis rufis violascenti micantibus, atomis nigris, margine anteriori, vittaque dentata albido irroratis" ('Die Schmet. in Abbildungen' &c., p. 482); whilst the figure to which this description refers, may be described as follows:—"Anterior wings dull purplish with dark costal streaks, the costa itself slaty, with a slaty transverse shade inside the subterminal line. Hind wings dark grey with pale base" (Plate 148, fig. 4). This is almost identical with the ordinary North British form I have from Morpeth, Darlington and Pitcaple.

ε. var. *pilicornis*, Brahm.—This is the most extreme grey form of *rubricosa*, with the red entirely covered with grey, and the transverse lines marked distinctly in brownish. Brahm's description is:—"The fore wings small, slightly overlapping; of an ashy-grey colour with a reddish tinge and glossy; a short, brownish, abbreviated transverse line, which loses itself in the ground colour; this is followed by a complete, brownish, wavy line, made up of lunar markings. The elbowed line still more waved, the points of the lunar marks turned outwards; the subterminal is pale and zigzag, but indistinct. Close to the fringe is a row of small black dots. Both stigmata are ashy-grey with a red-brown border; the transverse lines are tolerably pale, lined with darker on the outer margin, and make distinct short costal streaks at their origin; the outer border of the discoidals is also very distinct, a shade passing through the reniform from the costa to the inner margin." My examples of this extreme purplish-grey form have come from Morpeth, Pitcaple and Darlington. In Britain it appears to be a purely northern form.

Tæniocampa, Gn.

This is, without doubt, one of the most interesting of all our genera of NOCTUÆ. The species offer widely different superficial characters, and yet the resemblances are sufficient to make us recognise the close alliance that their larvæ prove them to have. Of the species comprised in *Tæniocampa*, *instabilis* and *opima* are very closely allied to one another, whilst *populeti*, superficially allied to these, appears to be more closely allied structurally to *stabilis*, and *munda* is, perhaps, next to *opima*, more closely allied to *instabilis* than any other; *gracilis*, in its typical form, appears to be fairly distinct, but its dark varieties run insensibly into those of *instabilis*, to which its shape also allies it. *Gothica*, through its var. *gothicina*, shows its relationship to *stabilis*, but the typical specimens have quite a close superficial resemblance to certain members of the genus *Noctua*, especially *N. c-nigrum*. Its larva &c., however, are *Tæniocampa*. *Miniosa* appears to be the most specialised, and, at the same time, the most aberrant member of the genus, and its closest affinities are with *stabilis* and *cruda*, although

they are not particularly apparent with either. The groups into which the species naturally fall are :—(1). *Munda*, *instabilis*, *opima*, *gracilis*.* (2). *Populeti*, *gothica*,* *stabilis*, *cruda*. (3). *Miniosa*. There is probably, no genus except the *tritici-cursoria* group of *Agrotis*, where the allied species show such a close parallelism in variation. The close alliance existing between certain species, at once suggests that such variation should be expected, for, as I have before stated, “if a slight modification and gradual development, owing to environment &c., bring about specific distinction, it follows, that reversion and ‘natural selection’ generally, will, under similar conditions, aid in the development of similar forms” (‘Entom. Record’ &c., vol. i., p. 217). This parallelism of variation is exhibited, not only in the coloration, but also in the size, position and shape of the stigmata, in the modification of the transverse, basal,肘ed and subterminal lines, and also in the central transverse shade, as well as in the development of the transverse row of dots or wedge-shaped marks parallel to the hind margin. In all the species, the characters which are normal in one are almost sure to be developed abnormally in the allied species, and *vice versa*. With regard to this parallel variation, Dr. Chapman writes :—“You find, I have no doubt, among the species of *Teniocampa*, what is true more or less in most genera, *viz.*: that each species varies in the direction of other species of the genus. Thus *munda* has a suffused (*cruda*) form. *Stabilis* has a form with a dark central shade (*instabilis*). *Cruda* has a rosy form (*miniosa*), a dotted form (*munda*), a form with well-marked stigmata (*stabilis*), &c. *Populeti*, *opima* and *instabilis* have a form with dots on the subterminal line (*munda*), and so on. I suppose one might work at them, till vars. of each species were obtained which represented each of the others” (*in litt.*). *Teniocampa instabilis* is perhaps the most variable species of the genus, if indeed it be possible to select one as “most variable,” where all vary so excessively. With a ground colour extending from a pale whitish-grey to the brightest red and most intense black, with a transverse shade extending sometimes as a broad black band, whilst at others it is quite obsolete, and with the transverse lines exhibiting almost every possible phase of development, it perhaps really deserves the term “most variable.” But *gracilis* and *opima* have equally pale and equally dark varieties, the former also equally red ones, whilst *populeti* has a most intense black form. *Stabilis* is sometimes of the palest grey, at others much suffused, whilst some are of the brightest red coloration. *T. pulverulenta* (*cruda*) and *miniosa*, perhaps, vary least, but still they do vary, and that considerably within narrow limits. The effect of environment on species is well exhibited in *instabilis*. The specimens from Hereford are of all forms, the pale ones, however, tending to reddish, but the dark ones very black. The dark ones are equally black in Kent, but the pale ones generally tend to grey, whilst, in Forres, the pale ones are apparently nearly all reddish-tinted, and dark forms are comparatively rare. This statement is based on the material at my disposal, and may have to be modified when more is known of the species in different localities, but at present more than 50 per cent of all the specimens I have received have been dark,

* These are transposed at ‘Entom. Record’ &c., vol. i., p. 217.

whilst only about 2 per cent of the Forres specimens have been so. I do not remember having seen any really pale specimens from Lancashire. All the different species, however, want a great deal of working, and a large amount of material is necessary before more can be done in this direction.

Tæniocampa, Gn., *munda*, Esp.

Esper's description of the type of this species is as follows:—"Alis cinereis stigmatè pallido, punctis nigris marginalibus binis." "The ground colour is pale brown with an ashy-grey tint." Esper's figures, supposed to correspond with this description, may be described as having:—"The anterior wings pale ochreous-brown, with the basal line, median shade (touching the inner edge of the reniform) and elbowed line fuscous; a row of six black dots on subterminal line parallel to hind margin; reniform and orbicular outlined in paler" ('Die Schmet. in Abbildungen,' p. 264, pl. 52, figs. 5 and 6). The ground colour varies from a clear whitish-grey, through dark grey, to reddish-ochreous and red-brown, the extremes being very striking. Both stigmata are occasionally obsolete, but the orbicular is much more frequently obsolete than the reniform, whilst, on the other hand, both are sometimes remarkably well-developed, and shaded very distinctly with fuscous. Except in very occasional cases, the lower part of the reniform is generally shaded with darker. Of the transverse lines, the central shade is most striking. It is frequently obsolete, sometimes of a red tint, which looks striking in the pale grey specimens, at other times it is fuscous. I have specimens in which it is almost as strongly marked as in the banded specimens of *incerta* (*instabilis*). The transverse basal lines are generally absent, occasionally they are both very clearly defined, although it is rare to find the abbreviated basal line so. The elbowed line when well-marked, which is very rarely, is composed of lunules, the subterminal line is pale, and generally has part of a series of dots developed on it. It is rare that these dots are altogether absent, sometimes two (the central) only are developed, the next to appear being those at the costa, then those at the anal angle. The intermediate ones are very rarely developed, when they are, a complete row is the result. As a rule, the ground colour is very clear, but some specimens sent me by Dr. Chapman are much speckled with darker scales, reminding one of the normal condition in *pulverulenta* (*cruda*). The most remarkable development that I have noticed in this species, is that of the peculiar black longitudinal striations in var. *striata*. The gradual transition from the total absence of the transverse row of dots before the subterminal, to a complete series, is made more interesting from the fact that these dots not only vary thus in number, but also in intensity, and specimens can be selected, in which every gradation from black through reddish-black, to pure red, to faint pinkish, and thence to total absence can be shown. Of the general variation of this species, Humphrey and Westwood write:—"The fore wings are of an ashy-grey, varying to pale ferruginous, slightly clouded with darker tints, with the ordinary stigmata and strigæ quite or nearly obsolete, the subapical one alone appearing very indistinctly, preceding three pairs of black dots, the middle ones being most distinct, the others being sometimes obsolete, as in the variety named by Haworth, *Noctua bimaculata*. Other varieties occur with a dark reddish-brown striga before the anterior stigma, a bent one of brighter colour between the

stigmata, a bent one behind the posterior stigma, and another subapical one marked, as in the others, with black dots, which are also occasionally obsolete" ('British Moths,' pp. 135-136); whilst Guenée writes:—"It would be impossible to divide the very numerous but little characterised varieties of this *Tæniocampa*. It is sometimes of a yellow-ochreous, or very reddish and almost unicolorous, at other times, of a testaceous-grey, very powdered. The black spots (on the subterminal) are sometimes in three pairs, sometimes reduced to the central pair, at other times altogether absent. But these differences are never simultaneous. It is therefore difficult to define the types of *geminata* (us) and *bimaculata*(us) of English authors" ('Noctuelles,' vol. v., p. 357).

There appears to be no simple way of sub-dividing the varieties except as follows:—

- 1.—Ground colour greyish-white = var. *pallida*.
- 2.—Ground colour dark grey = var. *grisea*.
- 3.—Ground colour pale reddish-ochreous = *munda*, Esp.
- 4.—Ground colour reddish or ferruginous = var. *rufa*.

Each of these groups can then be roughly sub-divided into the following sub-varieties:—

- a.—Without dots and indistinct transverse lines = *immaculata*, Stdgr.
- b.—With two dots and indistinct transverse lines = *bimaculatus*, Haw.
- c.—With two or more dots (generally six) and distinct transverse lines = *geminatus*, Haw.

We should thus get *immaculata-pallida*, *bimaculatus-pallida* and *geminatus-pallida*, as the sub-vars. of var. *pallida*, and so on for *grisea* and *rufa*. Of *munda*, since sub-var. *geminatus* with six spots and transverse lines represents the typical form, we should get *immaculata* and *bimaculatus* as reddish varieties of the type. Here we get a case where the different ground colours of a species present parallel varieties in the different colours. Hübner's fig. 166 (called by error *lota*) agrees with Esper's type, but has four spots instead of six. I would also draw attention to the fact that it must not be assumed that all specimens of sub-vars. *bimaculatus-pallida*, *-grisea* and *-rufa*, have suppressed transverse lines, central shade and stigmata, although it is generally so in my very long series, nor that *geminatus-pallida*, *-grisea* and *-rufa* have them distinct. In my series, some of the palest forms with the transverse lines totally suppressed, have as many as six or eight spots, and thus belong to the *geminatus* form.

a. var. *immaculata*, Stdgr.—This variety is thus described by Dr. Staudinger:—"Alis anterioribus maculis nigris ante marginibus nullis" ('Catalog,' p. 114). Taking the ferruginous spotted form as the type, the unspotted form, corresponding in colour &c. with the type is Staudinger's *immaculata*. I have the pale reddish spotless form from Hereford, Clevedon and Brecon.

β. var. *bimaculatus*, Haw.—This red variety with one pair of blackish spots in the centre of the subterminal line, is thus described by Haworth:—"Alis pallide ferrugineis punctis duobus posticis contiguis nigris." "Alæ anticæ subferrugineæ concolores stigmatibus fere obliteratis, exterius reniforme et ad latus interius saturatius: antè annulare obsoletissimum margine solo vix conspicuum. Alæ

posticæ pallidiores" ('Lepidoptera Britannica,' p. 121). This is a rather common form. I have it from Hereford, Clevedon, Epping &c.

γ. var. *pallida*, mihi.—This name I would apply to all those specimens which have a whitish or pale greyish-white ground colour. Among such specimens we find the following sub-varieties. (1). Anterior wings whitish or whitish-grey, with no distinct transverse lines, central shade and stigmata rather indistinct, and no black spots on the inside of the subterminal line = sub-var. *immaculata-pallida*. (2). Anterior wings whitish or whitish-grey, the transverse lines and stigmata generally rather indistinct, one pair of small black dots on the inside of the centre of the subterminal line = sub-var. *bimaculatus-pallida*. (3). Anterior wings white or whitish-grey, with the transverse lines, central shade and stigmata generally distinct, and two, three, or more pairs of small black spots on the inside of the subterminal line = sub-var. *geminatus-pallida*. This latter is the true *geminatus* of Haworth, who writes:—"Bombyx. Alis griseo-cinereis, subnebulosis, strigae posticae punctis tribus geminatis." "Exemplar solitarium tantum vidi. Duobus præcedentibus valde affinis at minus nebulosus: cilia immaculata: thorax cinereo-griseus: striga postica in alis anticis, ex maculis duabus seu tribus geminatis, una harum ad costam sub-simplex" ('Lepidoptera Britannica,' p. 121).

δ. var. *grisea*, mihi.—This differs from var. *pallida* in being of a darker grey ground colour, and generally much more powdered with dark scales. Among the specimens having this ground colour we find:—(1). Specimens with the transverse lines, central shade and stigmata indistinct, and with no black spots on the inside of the subterminal line = sub-var. *immaculata-grisea*. (2). With the transverse lines, central shade and stigmata more or less indistinct, but with one pair of spots on the centre of the subterminal line = sub-var. *bimaculatus-grisea*. (3). With the transverse lines, central shade and stigmata more or less distinct, and two, three, or more pairs of small black dots on the inner edge of the subterminal line = sub-var. *geminatus-grisea*.

ε. var. *rufa*, mihi.—This variety has a deep reddish-brown ground colour, and is thus darker than the more ochreous type and vars. *immaculata* and *bimaculatus*. Like vars. *pallida* and *grisea*, this has a sub-var. *immaculata-rufa*, without black spots on the inside of the subterminal line, sub-var. *bimaculatus-rufa* with one pair in the centre of this line, and sub-var. *geminatus-rufa* with two, three, or more pairs of such black dots.

ζ. var. *striata*, mihi.—The most remarkable development that I have seen in this species, consists of two black longitudinal lines, one running along the sub-costal nervure between the abbreviated and complete basal lines, the other along the median nervure, from the abbreviated basal line (at the origin of the former line), till it joins the dark spot filling up the lower part of the reniform. This specimen also has a small black quadrate spot between the orbicular and the reniform, the orbicular itself being indistinguishable, beside which, the transverse lines are well marked. It is altogether a very strange specimen.

Tæniocampa, Gn., *instabilis*, Fab. (*incerta*, Hufn.).

In looking over a drawer full of this variable species, for which I am chiefly indebted to Dr. Chapman of Hereford, and to a lesser extent to Mr. Finlay of Morpeth, and various Darlington and Nottingham

collectors, the first thing that strikes me is the extreme colour variation, extending from pale-whitish and slaty-grey to the most intense black, and passing through every possible shade of red and brown. With regard to the markings, the central shade is the striking character in the paler forms, but it becomes practically obsolete in the more unicolorous forms. The most striking character to me appears, however, to be the peculiar appearance presented by the specimens according as they have a gloss or not; the dull, and often more mottled appearance of the latter without a gloss, looking strikingly different to the smooth silky appearance of the former, even when the tint is identical. Of peculiar specimens which it is almost impossible to classify, I have a large number picked from hundreds by different friends. Dull greyish-black specimens; a blackish specimen mottled with reddish-brown, reddish-grey with whitish hind wings and no gloss, bright shiny red (from Warrington), as bright as the brightest red specimen of *Pachnobia rubricosa*, a pale grey with a central coppery tinge, from Cambridge, a specimen almost indistinguishable in shape and general appearance from *T. populeti*, specimens with united stigmata, and so on, are among the most noteworthy. The stigmata vary endlessly, but the orbicular appears to be always present; the reniform is variable in size, sometimes unicolorous, at others outlined in pale; sometimes 8-shaped with the upper and lower parts filled in with dark, at others with only the lower part dark; the subterminal generally almost unicolorous or only slightly paler than the ground colour, but varying to almost white; the central shade (generally including the reniform) very strongly developed in some pale specimens. Pale hind wings are very rare in this species, but I have two specimens in which they are almost white, and the colour of the hind wings may be traced through from this pale colour to deep blackish-grey. Hufnagel really gives no description of this variable species. He simply says "sometimes yellowish-red, sometimes ashy-grey, and sometimes red-brown with dark reniform enclosed in white." He also adds:—"The specimens of this species vary in detail very much, and hence care should be taken not to treat them as different species. The facies are the same in the main, and this must be kept in mind" ('Berlinisches Magazin,' III., pp. 298 and 424). There is, of course, no description here by which any species can possibly be recognised, and I have therefore taken the description of Fabricius as that of the type. It is as follows:—"Noctua lævis alis deflexis griseis: fascia media ferruginea." "Alæ anticæ griseæ, subundatæ fascia media, undata, ferruginea. Posticæ supra fusæ, subtus cinereæ puncto centrali, fusco." He also adds:—"Color alæ anticæ variat fascia ferruginea tamen semper constans" ('Entomologia Systematica,' 119). Of this species Guenée writes:—"The numerous varieties of this species may be divided into two chief races. The first, consisting of those in which ferruginous-red or liver-colour predominates and absorbs the markings; the other, in which the ground colour is ashy-grey, yellowish, or reddish, in which the markings are very apparent. In the first, we will consider the specimens of a clear ferruginous-red, almost unicolorous, as the type, which is well represented by the excellent figure of Hübner" ('Noctuelles,' vol. v., p. 350). Humphrey and Westwood write:—"This very variable insect measures from $1\frac{1}{2}$ to $1\frac{3}{8}$ inch in the expanse of the fore wings, which vary from a grey to a red-brown colour, variously shaded or marked with deeper tints, especially a darker, irregular, indistinct bar running across the wing between the

stigmata, which are ordinarily obsolete, but occasionally distinct and of a greyer hue than the rest of the wing, and slightly encircled with white. Near the apical margin of the wing is a pale striga, edged with brown on the inside, and rather elbowed near the costa, where the joints of the antennæ of the male have the sides angulated and setose. The varieties are very numerous. That named *subsetacea* (us) by Haworth, has the wings ashy, clouded with grey, and three grey lunules attached to the posterior whitish lunule. The *N. nebulosa* (us), Haw. has the wings hoary-grey, with two reddish-brown strigæ, and a terminal one formed of three sub-triangular spots. *Noctua fuscata* (us), Haw. has the fore wings blackish, with the two stigmata encircled with white rings, and a sub-apical, slightly undulated, pale striga; and *N. angusta* (us), Haw. has the wings varied with livid and brown colours, and with the stigmal circles and apical strigæ less distinct than in the preceding variety" ('British Moths,' pp. 134-135); whilst Newman writes:—"The wings are very different in colour and markings, the ground colour varying to almost every shade of ferruginous-brown and grey-brown, sometimes plain and almost unicolorous, at others mottled and marbled; the discoidal spots are usually entire, their circumscription clearly defined in pale grey, almost white; and there is also usually a very distinct pale line parallel with the hind margin; this is slightly irregular, scarcely so much so as to be called zigzag: the costal margin is usually paler and interrupted with darker spots; and there is generally a median transverse cloud. Notwithstanding the general occurrence of these markings, in some of my specimens they are scarcely perceptible, and in others entirely absent: the hind wings are grey-brown, the discoidal spot being distinctly darker and of a crescentic form; the fringe is paler" ('British Moths,' pp. 358-359). Of a most interesting experiment made by Mr. Fenn, by which he reared a very pale brood of varieties of this species, chiefly vars. *pallida* and *nebulosus*, we read:—"In April, 1890, I took a ♀ *T. instabilis* at sallow bloom, and noting her to be a very pale variety, I reserved her for oviposition, and she laid the remainder of her eggs. I reared a number of these as far as the pupa stage; and the large garden pot in which the larvæ went down was placed out of doors in a shady spot with a north-east aspect, about the very coldest place I could discover. The pot was exposed to the very severe temperature of the recent long frost, and from its position must have frequently been subjected to 30° of frost. The earth it contained, with the pupæ, was frozen hard for over six weeks. About January 23rd, when the frost had broken up, I removed the pot indoors and sorted out the pupæ, of which there were about five dozens, and I was glad to find that not one of them had succumbed to the cold. Laid in damp sand in a very cold room with an eastern aspect, and where no fire is ever lighted, these pupæ soon began to show signs of life. The first moth was bred on February 3rd, and to the present date at least 40 have emerged. Considering the temperature of the room where they were kept, they are at least six weeks in advance of their usual time. The moths bred follow to a great extent the variation of the parent ♀, and I have many very lovely pale grey, pinkish-grey, and other light forms; among them, of course, are a few of the ordinary type, the dark-reddish brown, and even these vary in intensity and markings. Not a single black specimen has emerged, although it is a very common form here. The larvæ were fed on

sallow. Here, at any rate, is a natural experiment which shows that heredity beats temperature out of all calculation. If Mr. Merrifield's experiments be correct, my *instabilis* should be certainly darker than usual, or, at any rate, some part of the brood should be darker, but the reverse is the case. This is an extreme case in point of temperature, for none of Mr. Merrifield's pupæ were ever frozen for six weeks, at least, as far as I recollect ('Entom. Record' &c., vol. ii., p. 55).

The following is a general classification of the chief varieties of this species:—

- 1.—Pale whitish-grey, with central band = *instabilis*, Fab.
- 1a.—Pale whitish-grey, without central band = var. *pallida*, Lampa.
- 2.—Pale slaty or bluish-grey, with central band = var. *cærulescens*.
- 3.—Dark slaty-grey, with reddish tint and central band = var. *nebulosus*, Haw.
- 3a.—Dark slaty-grey, almost unicolorous = var. *subsetaceus*, Haw.
- 4.—Pale brownish or reddish-grey, with central band = var. *trigutta*, Esp.
- 4a.—Pale brownish or reddish-grey, unicolorous = var. *rufo-grisea*.
- 5.—Dark brownish-grey, with central band = var. *virgata-brunnea*.
- 5a.—Dark brownish-grey, unicolorous = var. *unicolor-brunnea*.
- 6.—Dark shiny red-brown, with central band still darker = var. *instabilis*, Hb.
- 6a.—Dark red-brown, unicolorous = var. *instabilis*, Esp.
- 6b.—Dull red-brown = var. *contacta*, Esp.
- 7.—Reddish-black, unicolorous = var. *angustus*, Haw.
- 8.—Shiny black, unicolorous = var. *fuscatus*, Haw.
- 9.—Dull sooty-black, unicolorous = var. *atra*.
- 10.—Bright red, unicolorous = var. *rufa*.

a. var. *pallida*, Lampa.—This is described as having a whitish-grey ground colour. "The fore wings are pale greyish-white, with transverse rows of black dots (just like silk moire), with fine and short transverse lines." The original description is as follows:—"Framvingarne blekgrå, med tvänne tvärrader af svarta punkter, samt liksom vattrade af små och glesa tvärstrimmor:—Sverige, Stockholm" ('Entomologisk Tidskrift,' p. 72).

β. var. *cærulescens*, mihi.—I have a beautiful series of this variety given to me, bred by Mr. Fenn, this year (1891), from Lee, Kent. I have also specimens from Pitcaple, Hartley-Wintney, Nottingham, Darlington and Hereford. This is apparently the var. B of Guenée, who writes:—"Of an ashy-blue, much powdered with blackish scales, and marbled with an infinity of striations of the same colour, with all the lines, dots and markings of a deep blackish-brown. The orbicular spot has, in my specimen, accidentally without doubt, the form of a Z, and it touches the reniform, from which it is separated only in the middle by a small blackish dot. I have received this beautiful variety from England. Fig. 414 i of Engramelle resembles it slightly" ('Noctuelles,' vol. v., p. 352).

γ. var. *nebulosus*, Haw.—This reddish-tinted var. of *instabilis* is thus described by Haworth:—"Alis griseo-canescens strigis duabus fusco-ferrugineis, alteraque postica e punctis tribus subtriangularibus." "In medio alarum primorum fascia fusco-ferruginea seu grisea, in qua macula ordinaria, solo margine conspicua; ciliis maculatis. Alæ posticæ grisescentes margine saturatiore: margo ipse

rufescens" ('Lepidoptera Britannica,' p. 120). Of *nebulosus*, Guenée writes:—"The median shade is very contracted, very dark and interrupted in the middle, three principal ferruginous dots are noticeable on the subterminal. The series of dots is very marked. The complete basal line is ferruginous and generally traceable. The thorax has a reddish tint. The ground colour of the wing is lilac-grey" ('Noctuelles,' vol. v., p. 351). This is, perhaps, one of the most common forms obtainable in some parts of Scotland, almost all my specimens from Forres being of this variety or var. *trigutta*. I have also specimens from Hereford, Morpeth, Nottingham and Warrington.

δ. var. *subsetaceus*, Haw.—Haworth's description of this variety is as follows:—"Bombyx. Alis cinerascentibus griseo-nebulosis, lunulis tribus griseis ad strigam posticam albicantem." "Simillima præcedenti (*nebulosus*) et fere eadem. Antennæ (in mare) oculo nudo minime pectinatæ; stigmata albo cincta; inter hæc macula griseo ferruginea, alteraque opposita ad marginem tenuiorem. Alæ posticæ fusæ." "OBS. Variat magis minusque nebulosa, sed lunulæ posticæ extrorsum spectantes, in alis anticis semper remanent." ('Lepidoptera Britannica,' pp. 120-121). This form is much like the preceding, but instead of a distinctly darker, transverse median shade, this is but very little darker than the ground colour, and only the outlines of the stigmata and the subterminal line stand out conspicuously paler. My specimens have come from Hereford, Nottingham, Guestling and Darlington. Guenée refers *subsetaceus* to *collinita*, Esp., a var. of *gracilis*, an obvious error. This would appear to be Guenée's var. C, of which he writes:—"The ferruginous colour is much mixed with bluish ashy-grey, above all at the base, on the costa and on the terminal space. The subterminal line is, however, distinct, and bordered with red throughout its length" ('Noctuelles,' vol. v., p. 351).

ε. var. *trigutta*, Esp.—Esper's var. *trigutta* may be described as having "the anterior wings pale grey, tinged with reddish-fuscous, more especially on the inner margin. There is a distinct, transverse central shade, with a black apical mark. The hind wings grey, with a transverse row of black dots" ('Die Schmet. in Abbildungen,' Plate 147, fig. 4). This, as I have previously mentioned, is also a common Scotch variety. I have specimens from Forres, Nottingham, Winchfield, Morpeth, Bournemouth, Darlington, Hereford, Warrington and Germany.

ζ. var. *rufo-grisea*, mihi.—This is really a sub-var. of *trigutta*, Esp., with the median shade much reduced and the general markings more indistinct, although both are generally traceable. My specimens of this more unicolorous reddish-grey form came chiefly from Forres.

η. var. *virgata-brunnea*, mihi.—In this variety the grey is reduced to a minimum, the prevailing colour being dark brown. The median shade, however, stands out conspicuously. With the next (*unicolor-brunnea*), this forms a transition between var. *trigutta* and the vars. *instabilis* of Hübner and Esper.—I have specimens from Hull, Nottingham, Hereford, Warrington, Morpeth, Darlington and Germany. Sub-var. *unicolor-brunnea* is like the preceding in ground colour, but still more unicolorous, the median shade almost obsolete and absorbed into the surrounding area. My specimens have come from Hereford, Darlington, Hastings, Forres, Hull and Nottingham.

θ. var. *instabilis*, Hb.—This is the first of the really deep-coloured varieties which are so striking in this species. "The anterior wings

are deep reddish-brown; the extreme base (to the abbreviated, black transverse line) paler; the complete basal line dark red and wavy; the orbicular and reniform outlined in pale, the lower half of the reniform dark; a still darker red median shade runs from the costa to the inner margin, between the stigmata; the elbowed line indistinct, the subterminal edged with paler. Hind wings grey, margin darker, lunule distinct" ('Sammlung europ. Schmet.,' fig. 165.) This dark, red-brown form with a still darker median shade is fairly common. My specimens of this and the following (*instabilis*, Esp.) have come from Warrington, Pitcaple, Forres, Nottingham, Hereford, Darlington and Germany. Of this variety Guenée writes:—"We may consider as the type, those specimens of a clear, ferruginous-red, almost unicolorous, which form is represented very well by the excellent figure of Hübner" ('Noctuelles,' vol. v., p. 350).

ι. var. *instabilis*, Esp.—The dark unicolorous red-brown form without a darker median shade is the *instabilis* of Esper. Of this he writes:—"The fore wings have less infused spots and the discoidals are more distinct; the subterminal only is pale, whilst the elbowed line is bordered by streaks of black. Hind wings are dark grey with a black central lunule. I have received these specimens from the Tyrol." The figure referring to this description may be described as:—"Anterior wings dark red-brown, with the basal line black, and in contact with an 8-shaped orbicular; the reniform black, outline paler; subterminal line also paler, edged exteriorly with black" ('Die Schmet. in Abbildungen' &c., p. 496, pl. 151, fig. 3).

κ. var. *contacta*, Esp.—This is only a slight modification of the *instabilis* of Esper. The figure may be described as:—"Anterior wings dull red-brown, orbicular round, filled in with darker; reniform dark with a pale outline, the central median shade is developed in its upper part, and has the appearance of a quadrate spot between the orbicular and reniform, owing to the nervure, on which these stigmata are placed, being pale where it joins their bases; the subterminal line pale, with black outer margin. Hind wings pale grey" ('Die Schmet. in Abbildungen' &c., pl. 151, fig. 2). Of this variety Guenée writes:—"It is an insignificant modification of the type (*i.e.*, Hübner's *instabilis*), in which the colour is still more uniform, and in which the ordinary stigmata are well developed" ('Noctuelles,' vol. v., p. 351). My dullest red specimens have come from Hereford.

λ. var. *angustus*, Haw.—The diagnosis of this variety is:—"Alis spadiceo fuscoque variis annulis duobus, strigae postica fracta pallidioribus obsoletisque." "Præcedenti (*fuscatus*) nimis affinis, sed alis omnino angustioribus et spadiceo magis notatis" ('Lepidoptera Britannica,' p. 122). This dark reddish-black variety is not uncommon; I have a long series from different localities, including Darlington, Winchfield, Morpeth, Nottingham, Hereford and Warrington.

μ. var. *fuscatus*, Haw.—Haworth's description is as follows:—"Alis nigricantibus, annulis duobus strigae subundulata pallidis." "Stigmata margine solo conspicua, anticum oblongum, posticum reniforme. Alæ posticæ fuscæ fimbria obscura saturatiore. Mas magis obscurus quam femina" ('Lepidoptera Britannica,' p. 122). Of this variety Guenée writes:—"In this variety the ferruginous-red has passed into blackish hepatic-brown, which absorbs all the markings, often even the subterminal. The inferior wings are also darker, and in the case of the female the lunule is sometimes absorbed." "It

is found in England, whence I have received four examples" (*'Noctuelles,'* vol. v., p. 351). Staudinger writes:—"al. ant. fere unicolor. fuscis" (*Catalog,'* p. 113), a description belonging rather to var. *angustus*. I have specimens of this black variety from Warrington, Hereford, Darlington, Morpeth, Glasgow, Galashiels, Sheffield and Nottingham. A sub-var. (*grisea-fuscatus*) occurs, in which the black colour is dusted with grey scales especially in the basal area. Of this form my best specimens have come from Morpeth, Nottingham and Hereford.

v. var. *atra*, mihi.—Instead of the bright shiny black of *fuscatus*, this variety is of a dull sooty black colour, but as intense in depth as is *fuscatus*, and with scarcely the slightest trace of any markings whatever. It is a most interesting variety. My specimens have come from Darlington, Morpeth and Hereford.

ξ. var. *rufa*, mihi.—Probably the most beautiful of all the vars. of *instabilis* that I have ever seen is a bright-red specimen sent me by Mr. Collins of Warrington. The colour is altogether unlike the redness of the other varieties in this species, and I have never seen another specimen in any way approaching it.

Tæniocampa, Gn., *opima*. Hb.

This close ally of *instabilis*, without presenting any of the polymorphic tendencies of the latter species, still presents a wide range of coloration, the palest specimens being quite whitish-grey, the darkest, deep blackish-brown, the bright slaty or purplish form being comparatively rare. The stigmata are frequently united, whilst in very pale and very dark specimens the basal and elbowed lines frequently become obsolete. In almost all pale specimens there is a trace of a central line, which is frequently developed into a broad well-marked band, and the subterminal line is generally edged internally with darker. The hind wings vary almost in direct proportion to the intensity of coloration of the upper wings, the paler specimens having pale hind wings, the darker specimens dark ones. Of the variation of this species Newman writes:—"There are two principal varieties—the first, pale grey-brown, with a darker median shade; the second, uniform darker brown, without a darker median shade; in both instances the discoidal spots are distinctly outlined in pale grey, and there are usually three pale transverse lines." He also writes:—"There seems to be a constant difference between this species and *instabilis*, the third pale line being more direct in *opima* than in *instabilis*, in which I have described it as slightly irregular: in other respects they are very similar; but I have always observed that *opima* is far more constant in colouring. The two varieties noticed above are the only ones which are at all of frequent occurrence" (*'British Moths,'* p. 359). Both Hübner's type and his var. *firma* belong to the purplish or slaty form. The type may be described as:—"Anterior wings of a grey coloration, with a slight purplish tinge, all the nervures blackish; an oblique basal line, starting from the costa, is continued under the orbicular to the inner margin; the elbowed line also blackish. The space between these transverse lines blackish, except just along the costa, a still blacker, transverse median shade showing through this dark band, between the stigmata. The subterminal line is pale, the extreme hind margin spotted; the nervures between the elbowed and subterminal lines distinct and blackish. Posterior wings

grey (with a greenish tinge); short black lines from the base run down the median and basal nervures, whilst a black line, starting from the anal angle, runs parallel to and at a little distance from the hind margin" ('Sammlung Europ. Schmet.,' fig. 424). The modified form, with the same ground colour, in which only the transverse median shade is present but not developed into banded form, is called *firma* by Hübner. Guenée writes:—"One would get a very erroneous idea of this species, a near neighbour to *instabilis*, if judged by Hübner's figure. It differs from *instabilis* by always being slightly smaller; the superior wings more pointed at the apex; the subterminal line less broken at the costa, and sometimes quite complete, always continuous, almost straight, shaded throughout its length, without darker wedge-shaped spots; by the median space being narrower at the bottom and always darker; by the inferior wings being less powdered and rarely marked with a lunule above. It forms, otherwise, two well-marked races, which, if the description of the larva, given by Treitschke, is exact, might be well separated into two species. That of Hübner, which inhabits Austria, and which must be considered as the type, has the wings of a clear bluish-grey, with all the markings hepatic-brown, and the extremity of the fringes tinted with the same coloration. It varies little." "*Firma*, Hb., which I have often considered a variety of *instabilis*, belongs here. It represents the ordinary form even better than the original figure. However, neither is very exact." Concerning our British specimens, Guenée further writes:—"Those from England are of a more ochreous-grey, with the markings smoky-brown, the stigmata more distinct and more clearly surrounded with yellow; the subterminal line broader, more ochreous, a little more broken at the summit. It appears to be as variable as *instabilis*, especially in colour. I have a specimen in which the smoky colour has suffused all the wing with the exception of the subterminal line, as in the variety *fuscata* of *instabilis*" ('Noctuelles,' vol. v., pp 352-353).

The following is a table of our best known varieties:—

- 1.—Glossy slaty-grey (almost purplish), with a median transverse line = var. *firma*, Hb.
- 1a.—Glossy slaty-grey, with broad central band = *opima*, Hb.
- 2.—Greyish-white, with central shade quite or almost obsolete = var. *grisea*.
- 2a.—Greyish-white, with central shade developed into a band = var. *virgata-grisea*.
- 3.—Greyish-brown, almost unicolorous = var. *intermedia*.
- 4.—Dark-brown, stigmata and subterminal line paler = var. *brunnea*.
- 4a.—Dark-brown, unicolorous = var. *unicolor*.

a. var. *firma*, Hb.—This is really a very slight modification of the type, the anterior wings having the same glossy purplish shade, but a little darker in the general ground colour, and the central band of the type becomes reduced to a single dark central shade running between the stigmata. Hübner's figure may be described as:—"Anterior wings dark slaty-grey with the stigmata outlined in bluish-grey; a dark transverse median shade commences on the costa, passes between the stigmata, and ends on the inner margin; the subterminal line is blackish outlined with ochreous. Hind wings dark-grey with paler base, lunule very distinct" ('Sammlung europ. Schmet.,' fig. 676).

My specimens have come from Wakefield, Bolton and S. Anne's-on-Sea.

β. var. *grisea*, mihi.—This is the palest variety of the species, and is the form generally obtained in England, where the purplish-tinged forms are rare. Guenée says of this variety, which he calls var. A:—"This is the English form. It is of a more yellowish-grey, with smoky-brown markings, the stigmata more distinct and more clearly surrounded with ochreous; the subterminal line is broader, more yellow, a little more broken on the costal margin" ('Noctuelles,' vol. v., p. 353). This is, perhaps, our commonest British form. I have specimens as nearly as possible unicolorous, pale-grey, without any trace of markings, but *grisea*, generally, has slight traces of a median shade. My specimens have come from Birkenhead; York, Bolton and S.-Anne's-on-Sea.

γ. var. *virgata-grisea*, mihi.—This is a modification of var. *grisea*; the more or less ill-developed median shade in the latter being, in this, developed into a broad central band extending from the basal to the elbowed line and enclosing the stigmata; otherwise the basal and outer areas are of the same pale greyish colour. It is a rarer form than the last. I have specimens from Morpeth and Darlington.

δ. var. *intermedia*, mihi.—The smoky-brown central shade of the last variety, in this, infuses the whole area of the wing, which thus becomes of a greyish, smoky-brown coloration, without the deep brown of the following varieties. My specimens have come from York, S. Anne's-on-Sea, Bolton and Darlington.

ε. var. *brunnea*, mihi.—This is a much darker variety, the ground colour being of a deep brown, with the stigmata outlined in paler, and the subterminal also paler throughout its length. This is the more common of our two darkest varieties. My specimens have come from Darlington, Bolton, Morpeth and Wallasey.

ζ. var. *unicolor*, mihi.—This is the darkest and most unicolorous of the varieties of the species, even the pale outline to the stigmata and the pale subterminal line blending here with the dark ground colour. It is a rather uncommon form, and much rarer than var. *brunnea*. My specimens have come from Morpeth, Wallasey, Wakefield and Darlington.

Teniocampa, Gn., *gracilis*, Fab.

The variation of this species is, perhaps, less understood than that of any other in the genus. Most of our British specimens are greyish-white, more or less sprinkled with tiny black dots; occasionally a specimen that has an orange or rosy tint occurs in localities where the paler forms are common; but it is only in a few isolated localities in Kent and around the New Forest, that the dark brown and bright red-brown forms of *gracilis* occur. Of these dark forms, Esper gives a figure which may possibly refer to this species, under the name of *collinita*, but he refers to and gives Fabricius' description of *gracilis*, in connection with the figure. The diagnosis of Fabricius is:—"Noctua lævis, alis deflexis fusco cinereis: striga undata fusca baseos, flavescenteque apicis, intermedia punctata." "*Noctua* fere indistincta. Alæ obscuræ, basi striga nigricante, in medio maculae ordinariæ fere obsoletæ, pone has striga e punctis nigris, aliaque flavescens. Posticæ subtus albidæ striga e punctorum nigrorum" ('Mantissa,' p. 148, No. 98). In general variation the following points

are the most noteworthy. The orbicular varies much in size, shape and position, and, whilst generally of the ground colour, is sometimes filled in with darker; the reniform may consist of a simple pale outline, but generally the lower part is filled in with black, and it then becomes very striking; the claviform is generally distinct. As is frequently the case in the genus, the orbicular and reniform are sometimes united. The basal lines are generally indistinct and sometimes obsolete. The肘ed line has a series of dots on its outer edge, and these occasionally show a tendency to form a wavy line. The subterminal line is generally very pale, sometimes edged with darker inside, whilst occasionally it is unicolorous with the rest of the wing. The base of the hind wings is generally white, the outer area being dark grey; sometimes there is a row of dots on the nervures; but none of these differences are sexual, as frequently the females and males have entirely pale hind wings and *vice versa*; the hind wings of the females are, on the whole, paler than those of the males. The fringes are occasionally tinged with rosy.

The following is an attempt to classify the principal forms:—

- 1.—Pale greyish-white, not mottled with black atoms = var. *pallida*, St.
- 1a.—Pale greyish-white, much mottled with black scales = var. *sparsus*, Haw.
- 1b.—Pale greyish-white, subterminal line ochreous (yellowish) = *gracilis*, Fab.
- 2.—Pale-reddish or orange, not mottled with black scales = var. *rosea* (*pallida*, Gn.).
- 2a.—Pale-reddish or orange, mottled with black scales = var. *rosea-sparsus*.
- 3.—Almost unicolorous dark-red = var. *rufescens*, Ckll. ('Ent.,' xxii., 4.)
- 4.—Almost unicolorous dark-brown = var. *brunnea*.

a. var. pallida, St.—This is the palest form of the species, of an uniform greyish-white with very few darker markings and dark scales. The most conspicuous mark on these pale specimens is the dark shading in the lower part of the reniform. This is sometimes, however, absent, and the specimen is then almost unicolorous. Stephens' diagnosis is:—"Alis uniformiter pallescentibus, strigâ posticâ rufâ extus albidâ, aliâque punctorum, stigmatibus pallido marginatis" ('Illus. Haust.' (1829), p. 143). My specimens of this form have come from Seaton, Hereford, S. Anne's-on-Sea and Ireland.

β. var. sparsus, Haw.—There is practically no difference between this and the Fabrician type, except that the latter has an orange or reddish subterminal line, while this has a grey one. Haworth's description is:—"Bombyx. Alis griseo-cinereis atomis fuscis, strigâ posticâ fusco-alba. Femina tota griseo-cinerea atomis fuscis minutissimis, strigâque punctorum fuscorum pone stigmata fusciscentia. Versus marginem posticum striga fuscens extus albicans. Alæ posticæ cinereæ fimbria lata fusciscente" ('Lepidoptera Britannica,' pp. 122-123). My specimens have come from Wicken, Brecon, S. Anne's-on-Sea, Darlington and Wallasey.

γ. var. rosea, mihi. (= *pallida*, Gn.)—Guenée's description is:—"Of a paler colour, more rosy, and almost without black atoms" ('Noctuelles,' vol. v., p. 356). Guenée erroneously referred this to Stephens' *pallida*, which is in reality a white form. I have some very

pretty pale rosy (*miniosa*-coloured) specimens from Wicken and S. Anne's-on-Sea.

δ. var. *rosea-sparsus*, mihi.—Sometimes the speckled specimens are tinted entirely with reddish, and form a parallel variety to *sparsus*, Haw., as Guenée's var. *pallida* does to Stephens' var. of the same name. My specimens of this form have come from S. Anne's-on-Sea and Ireland.

ε. var. *rufescens*, Ckll.—A very dark red-brown form of *gracilis*, with distinct stigmata, which is rather sparingly distributed in our collections, is found in the New Forest and Kent. It is a very beautiful and extreme form, and with a tendency to approach the beautiful var. *rufa* of *instabilis* in colour. A very fine series from the New Forest was exhibited by Mr. Percy Bright at the City of London Entomological Society (as noted in the 'Entomologist's Record' &c., i., p. 216), when a series from Kent was also exhibited by Mr. Boden. It is also recorded from Rannoch, by Mr. Carrington, in 'Proc. Sth. Lon. Ent. Soc.,' 1886, p. 35.

ζ. var. *brunnea*, mihi.—This is an extreme form of var. *rufa*, in which the red coloration has become a dull red-brown. This form is very rare. I have only seen specimens from the New Forest.

Tæniocampa, Gn., *populeti*, Fab.

This species has nothing like the extreme range of colour variation of some of the allied species, but it varies, nevertheless, from a comparatively pale grey to an almost absolute black, although I have only seen one specimen of the latter coloration, and that was given to me by Dr. Chapman. The basal lines are generally distinct, whilst the orbicular and reniform vary from perfect obsolescence to distinct pale-ringed stigmata; occasionally they are united, but the orbicular is rarely so distinctly marked or so noticeable as the reniform. The elbowed line is occasionally obsolete, but sometimes consists of a double wavy black line. The subterminal line varies also in a similar manner, from perfect obsolescence to a pale line bordered by a series of dots, sometimes black and sometimes red. Of this species Guenée writes:—"This species differs markedly from *instabilis* by its pectinated antennæ, and from *stabilis* by its purplish-ash colour; the subterminal, much less marked, is preceded by small black dots rarely contiguous; the reniform is always very distinct, entirely filled in with blackish-grey" &c. ('Noctuelles,' vol. v., p. 353). Guenée also adds:—"Treitschke places here the *B. donasa*, Esp., pl. 52, fig. 7, but I dare not thus establish it; it only resembles our *populeti* in its pectinated antennæ. On the other hand, Engramelle figures a specimen, sent by Esper himself, under this name, to M. Gerning, which belongs evidently to *gracilis*" (l. c. pp. 353-354). The type of this species is thus described by Fabricius:—"Bombyx alis incumbitibus griseo nitidis: striga postica punctorum nigrorum." "In medio alæ macula ordinaria, reniformis, pallida, postice striga fere obsoleta e punctis tribus aut quatuor" ('Entomologia systematica' &c., p. 476). The *subplumbeus* of Haworth is also the type. Haworth's diagnosis is:—"Alis plumbescitibus griseo subnebulosis, striga obsoleta postica e punctis griseis extus pallido adnatis" ('Lepidoptera Britannica,' p. 121).

The following table comprises the varieties known to me:—

- 1.—Grey, with indistinct or obsolete stigmata and strigæ = var. *obsoleta*.
- 1a.—Grey, with well-marked strigæ and one or two dots on subterminal = *populeti*, Fab.

- 1b.—Grey, with well-marked strigæ and complete row of dots on subterminal = var. *ocularis*, Frr.
- 2.—Grey, with central area reddish-brown = var. *donasa*, Esp.
- 3.—Dark grey-brown = var. *intermedia*, St.
- 4.—Black = var. *nigra*.

a. var. *obsoleta*, mihi.—This is the most obsoletely marked form of the species, of a pale greyish colour, with the slightest trace of purplish; the stigmata almost or quite obsolete, as are also the basal lines; the elbowed line, when at all distinguishable, very pale.

β. var. *ocularis*, Freyer.—This is that grey form in which the markings are very strongly developed, and a complete row of dots is found on the subterminal line. Freyer writes:—"It is of the size of *N. lota*. The ground colour is of a mouse-grey, something like that of *N. respersa*. There is a dark basal line, and the stigmata are surrounded with pale ochreous, the reniform being filled in with a darker tint than the ground colour. A pale, transverse zigzag line runs between the reniform and the fringe, whilst another line, consisting of a series of blackish dots, is edged with paler. The hind wings are pale grey." The figure which illustrates this description has "the anterior wings ashy-grey, with an abbreviated, followed by a complete fuscous basal line; the reniform and orbicular with a pale outer margin, whilst a dark fuscous median shade runs from the base of the reniform to the inner margin; the subterminal line is pale and has a series of seven black dots on it. The median nervure, and those nervures on the outer margin, pale. Hind wings dark-brown" ('Beiträge zur Geschichte' &c., pp. 168-169, pl. 95, fig. 2).



γ. var. *donasa*, Esp.—This variety has the central area of the wing, especially around the stigmata, filled in with reddish-brown. Esper's diagnosis is:—"Alis cinerascentibus nebulosis, maculis rufis, striga marginali albida." The figure to which this description refers has "the anterior wings grey (slightly purplish), with the central area reddish; the inner margin and extreme base also reddish; the transverse lines and outline of reniform paler" ('Die Schmet. in Abbildungen,' p. 264, pl. 52, fig. 7). I have two specimens of this variety from Rannoch with wavy basal and elbowed lines, the space around the stigmata filled in with reddish-brown and red-brown shading almost to the subterminal line.

δ. var. *intermedia*, St.—This is the darkest ordinary form of the species which Stephens describes as:—"Alis anticis griseo-fuscis, fasciis tribus saturatoribus, annulis duobus strigisque ordinariis pallidis, strigâ posticâ duplice; antennis maris valdè pectinatis" ('Illus. Haust.,' II., p. 140); whilst Humphrey and Westwood write of it:—"This species measures $1\frac{1}{2}$ inches in the expansion of the fore wings, and is closely allied to the preceding species, from which, however, the much more strongly pectinated antennæ of the males remove it; the fore wings are of a grey-brown colour, with three darker fasciæ, the stigmal circles and ordinary strigæ being pale, the hinder striga is duplicated. The hind wings are dusky ash, with the cilia slightly rosy. Found in Richmond Park, by Mr. Stephens" ('British Moths,' p. 135). Of this dark grey-brown form intermediate between the pale grey and the black form, I have specimens from Hereford, Darlington, Burton-on-Trent and Derby, but the form is rare, and I have been able to pick out only a few specimens of this

form from the large number of the species that has passed through my hands.

ε. var. *nigra*, mihi.—I have never seen but one black specimen of *populeti*, and that was given to me by Dr. Chapman. The ground colour of the anterior wings is quite black; these have slightly paler transverse lines with very dark edging; there is a pale ring to the orbicular and to the reniform, whilst the characteristic black dots on the subterminal are of a dark red-brown colour. My specimen came from Hereford.

Tæniocampa, Gn., *gothica*, Linn.

This is certainly, next to *instabilis*, the most protean of all our *Tæniocampid* species. In ground colour, it varies from a clear greyish-white through almost every shade of pale reddish-grey, bright red and purplish-red to dark brownish-fuscous or even blackish-fuscous. The anterior wings are sometimes uniformly coloured, at other times much mottled, especially between the elbowed and subterminal lines. But the great character in the species is the variation in the characteristic -like character round the orbicular, from which it has received its specific name. This varies in colour from deep black and red-brown to a pale reddish-grey, and in shape, from the typical form just mentioned to complete obsolescence. Sometimes only the quadrate mark between the stigmata is present, at others, the two quadrate marks, the one between the stigmata and the one beyond the orbicular are present, but with no basal line joining them. Occasionally, the spot between the stigmata and the basal line is present, but not the one beyond the orbicular. One of the most rare modifications in this character, is for the basal line joining these spots, to assume a curved or arched form. I am indebted to Dr. Chapman for the forms I have. The form in which this dark *gothica*-mark becomes reduced almost to the ground colour, has been called *gothicina*, H.-S. in Britain, but almost every colour variety has its *gothicina*-like form. Another strange mark, the origin of which appears difficult to explain, is the short longitudinal mark under the reniform. Where an -like mark occurs, as in *Apamea*, *Miana* &c., it is easy to trace it as a modification of the claviform. Here it is nothing of the kind. The mark originates on the elbowed line, not on the basal line, and, whilst generally extending to the apex of the claviform, in some specimens it actually obliterates it. The claviform is indistinct, very pale, with no darker outline to make it conspicuous, and varies very much according as the small, longitudinal line just mentioned encroaches more or less on its area. The transverse lines are generally fairly distinct, forming small black costal streaks at their commencement. The subterminal line, near the anal angle, develops a distinct lunular mark, but the most prominent character of the transverse lines, is the occasional development of a broken black inner margin to the elbowed line throughout the whole of its length. Of this species, Guenée writes:—"It varies a little, especially in colour, which is of a violet tint, more or less blackish or reddish, but never sufficiently constant to form two races, although the old authors divided it into two species. It is clear that Fabricius himself perceived that this sub-division was of little value, 'Nimis affinis *gothica*,' he said. Hübner has figured a very strange variety, otherwise it would not be necessary to refer to his plate, which is, in all respects, inferior to that of Knoch" ('Noctuelles,' vol.

v., p. 348). The type of this species is described as follows:—*“Phalæna. Noctua spirilinguis cristata, alis deflexis superioribus fusciscentibus: arcu nigro linea alba marginato.”* “*Alæ in medio arcu nigro extrorsum verso, margine undique albo, cum adjecto puncto nigro ad latus interius*” (*Systema Naturæ*, v., p. 516). My specimens of the dark type have come from Hereford, Darlington, Morpeth, Nottingham, Warrington and Chesham.

The following is an attempt to classify the various forms:—

- 1.—Pale whitish-grey, with distinct black *gothica*-mark = var. *pallida*.
- 2.—Dark grey, mottled with paler, and with a dark *gothica*-mark = var. *variegata*.
- 2a.—Dark grey, mottled with paler, with pale or obsolete *gothica*-mark = sub-var. *obsoleta-variegata*.
- 3.—Dark blackish-grey, with dark *gothica*-mark = *gothica*, Linn.
- 3a.—Dark blackish-grey, with pale or obsolete *gothica*-mark = sub-var. *obsoleta*.
- 4.—Pale reddish-grey, generally mottled, with dark *gothica*-mark = var. *rufescens*.
- 4a.—Pale reddish-grey, with pale or obsolete *gothica*-mark = sub-var. *obsoleta-rufescens*.
- 5.—Unicolorous reddish, with dark *gothica*-mark = var. *suffusa*.
- 5a.—Reddish, with pale or obsolete *gothica*-mark = sub-var. *gothicina*, H.-S.
- 6.—Bright red with dark *gothica*-mark = var. *rufa*.
- 6a.—Bright red, with pale or obsolete *gothica*-mark = sub-var. *obsoleta-rufa*.
- 7.—Deep red-brown (with purplish tinge), with dark *gothica*-mark = var. *brunnea*.

a. var. pallida, mihi.—This, the palest variety of the species, has the ground colour whitish-grey, with a few darker marblings; the characteristic *gothica*-mark passing under the orbicular being blackish or dark reddish-brown. Occasionally, some specimens have this ordinarily dark mark of a pale colour and almost unicolorous with the rest of the wing, forming sub-var. *obsoleta-pallida*. My specimens of var. *pallida* have come from Morpeth. I once saw a specimen of the var., bred by Mr. A. E. Hall of Sheffield.

β. var. variegata, mihi.—In this variety the whitish-grey ground colour is rather darker grey, some of the specimens being very much mottled with paler, especially about the central area and subterminal line. The characteristic *gothica*-mark is well-developed, and it is very rarely that a specimen is captured with this mark reduced completely to the ground colour. Such, however, do occur, and form sub-var. *obsoleta-variegata*. I have a specimen from Rannoch. My specimens of var. *variegata* have come from Darlington, Morpeth, Chesham, Strood, Warrington and Hereford.

γ. var. obsoleta, mihi.—The sub-var. *obsoleta* has the same dark blackish-grey coloration that characterises the type, but is without the dark reddish-brown or blackish *gothica*-mark around the orbicular. A dark blackish form of this species with this mark obsolete is very rare. I have only one specimen which was captured and given to me by Mr. Milburn of Darlington.

δ. var. rufescens, mihi.—This pale reddish-grey form varies con-

siderably in the amount of red in the ground colour. Some specimens are almost as pale as var. *pallida*, with a slight reddish tinge, others are very grey, and much more suffused. Almost all these pale reddish forms are, however, much mottled in the central area, and about the subterminal line the pale mottlings occasionally having a somewhat ochreous tinge. As a red variety, it bears almost the same relation to var. *brunnea*, the darkest of the red varieties, as does var. *pallida* to the dark black-grey type, *gothica*. It has the dark characteristic *gothica*-mark, and is a not uncommon form. The sub-var. *obsoleta-rufescens*, in which the dark *gothica*-mark is obsolete or very pale, is the most common of all the obsolete forms, and is generally known as *gothicina*, a name belonging to its darker and duller red relative. My specimens of var. *rufescens* have come from Hereford, Portland, Darlington, Nottingham, Chester, Strood, St. Anne's-on-Sea, Morpeth and Rannoch. My specimens of the obsolete sub-var. have come only from Hereford and Rannoch.

ε. var. *suffusa*, mihi.—This form has the ground colour, entirely reddish, with the characteristic dark *gothica*-mark well developed. It is very rarely mottled, and is altogether a more unicolorous, as well as redder variety. The reddish sub-variety, in which the *gothica*-mark is fainter and reddish in colour, has been described as *gothicina* by Herrich-Schäffer. His special diagnosis is:—"Inter stigmata ambo macula quadrata ferruginea." He then adds:—"What is black in *gothica* is rust-coloured in *gothicina*. I have both sexes from Lapland. The species resembles *gothica* very much. The size, shape and markings are the same as in that species, the colouring, however, is very different. The ground colour is rust or reddish in the central area of the wing, with slaty-grey discoidals and similarly coloured shading on the costa, with pale transverse lines. There is no trace of black in the *gothica*-mark. The outer transverse wavy subterminal line and interrupted row of dots on it are ochreous. The hind wings and undersides are brown-grey as in *gothica*" ('Systematische Bearbeitung,' vol. ii., p. 196, figs. 125-6). This form is not really an obsolete form as we are apt to consider it. Herrich-Schäffer, accustomed to the dark Linnæan type, appears to lay stress, firstly, on the ground colour, secondly, on the red *gothica*-mark. The application of the name *gothicina* to our pale Scotch specimens with a purely obsolete *gothica*-mark is therefore entirely wrong, the name being applied by Herrich-Schäffer to a form which appears to be generally distributed in Britain and to be found with the other endless varieties of the species, wherever the species is common. I have specimens of var. *suffusa* from Hereford, Darlington, Morpeth and Rannoch; and var. *gothicina*, in its restricted sense, from the same localities. I have only seen perfectly obsolete vars. from Rannoch.

ζ. var. *rufa*, mihi.—A bright red form of this species has been sent to me in some numbers by Dr. Chapman of Hereford, but I have not seen it from any other locality except Forres. A sub-var., *obsoleta-rufa*, also occurs, in which the characteristic black *gothica*-mark is ill-developed in a paler shade of red. I have only one specimen of the obsolete form.

η. var. *brunnea*, mihi.—This is a deep reddish-brown form of *gothica*, much more widely distributed than var. *rufa*. I have never seen, however, an obsolete specimen of this variety. The ground colour is frequently tinged with purplish, which gives it a very pretty

appearance. It is the darkest of the red varieties. My specimens have come from Morpeth, Hereford, S. Anne's-on-Sea, Nottingham, Portland and Warrington.

θ. var. nunatrum, Hb.—“The ground colour of this variety is yellowish, with the costal area slaty-grey; the extreme base is of the ground colour, with an abbreviated black transverse line, followed by a dark patch, slaty on the costa, but dark brown on the inner margin, which is, in turn, followed by a complete basal line. The lower half of the orbicular and the whole of the reniform are outlined in yellowish, the space between the stigmata is dark brown, the colour being continued under the orbicular, whilst directly under this mark the colour is yellowish. A small yellow costal patch beyond the reniform is followed by a broad blackish line, edged internally with pale, which is in turn followed by a transverse series of yellow patches, bounded by the pale subterminal line, beyond which the outer area is very dark, except a series of pale arches on the extreme hind margin. Hind wings dark grey on the outer margin, paler at the base, with two pale transverse lines running through the darker area” (‘Sammlung europäischer Schmet.’ fig. 112). I have no variety similar to Hübner's specimen.

Tæniocampa, Gn., *stabilis*, View.

Another variable species, but without the extreme range of either *instabilis* or *gothica*. The ground colour varies from a pale whitish-grey or slightly ochreous-grey, through reddish-grey, bright red and dark red to brownish-black. One of the characters of the species is the presence of the pale nervures between the elbowed line and outer margin. The two basal and elbowed lines are generally ill-developed, although occasionally a specimen presents the feature of these being represented by fine distinct wavy black lines. The stigmata present, however, the chief character of this species. They are generally exceedingly well-developed, but vary much in relative position. Sometimes they are placed well apart, at others, quite in contact, and there is, besides, every intermediate form. The central shade, although hardly so striking a character as in *instabilis*, is sometimes remarkably well-developed. The subterminal line is generally whitish, but frequently orange, with a red line or shade on the inner edge, the outline of the orbicular is generally outlined with the same colour as that of the subterminal line. Of this species Humphrey and Westwood write:—“The varieties are very numerous; that named *N. juncta* by Haworth has the wings reddish-grey, with the rings surrounding the stigmata united, and a pale sub-apical striga (Mr. Haworth, however, mentions that the antennæ are less pectinated in this than in the type). The *N. rufannulata* of Haworth, has the wings reddish-brown, with a subapical red striga margined externally with pale, and the stigmata separate and margined with red. In other varieties the ordinary strigæ are more distinct, and in some specimens there is a dark broad bar between the stigmata” (‘British Moths,’ p. 137). The *cerasi* of Fabricius and the *cerasus* of Haworth represent the same pale reddish-grey form as Vieweg's type. Vieweg's description of the type is as follows:—“*Noctua stabilis* alis deflexis griseo-ferrugineis, macula strigae postica flavescentibus: margine nigro punctata.” “The fore wings reddish-grey. In the middle of the fore wings stand the reniform and orbicular, with a paler (yellowish) transverse line on

either side ; the subterminal line and reniform outlined with yellowish. The inside of the reniform filled in with dark " ('Tabellarisches Verzeichniss,' p. 12 ; p. 14 by error, in Staudinger's 'Catalog,' p. 113). I have two very marked sub-varieties of the type ; in one of these the basal and elbowed lines are distinctly black and wavy throughout their length, with a distinct black central shade. In the second, the space between the dark central shade and the pale subterminal line is darker than the ground colour, thus forming a transverse band. The former specimen came from Morpeth, the latter from Hereford. There are two essential ground colours on which the variation is based ; in one of these, grey is the prevailing colour, in the other, red.

The following are the principal forms :—

- 1.—Pale stone-grey (sometimes slightly ochreous) = var. *pallida*.
- 2.—Dark grey = var. *obliqua*, Vill.
- 3.—Brownish or blackish-grey = *stabilis*, Hb. = var. *suffusa*.
- 4.—Pale reddish-grey = *cerasi*, Fab. = *cerasus*, Haw. = *stabilis*, View.
- 5.—Bright red = var. *rufa*.
- 6.—Dark reddish = var. *rufannulata*, Haw.

a. var. pallida, mihi.—This pale form of *stabilis* is paler than the palest *opima*, and almost as pale as the palest *gracilis*. It has not, however, the clear grey of *gracilis*, and contains more ochreous than the palest form of *opima*. There is an indistinct abbreviated basal line, followed by a complete one, the latter sometimes edged externally with dark shading ; the reniform and orbicular are surrounded with pale, sometimes quite distinct, at others, joined and forming a longitudinal mark resembling the figure 8 ; although distinct in the darker forms, the claviform is very indistinct in this paler variety ; the elbowed line is faint, sometimes edged externally with a row of minute dots ; the subterminal is pale, shaded internally with darker (generally reddish). There are occasional traces of a central band. My specimens have come from Morpeth, Hereford, Somerset, Warrington, Carlisle, Pitcaple and Forres.

β. var. obliqua, Vill.—This dark grey form of *stabilis* is much commoner than the last. It is similar to var. *pallida*, but has the ground colour powdered very much with dark scales. Not only is the ground colour darkened, but the pale markings stand out more strikingly pale, by reason of the darker edging to them, and the central shade, sometimes passing through the reniform, is generally distinct and well-developed. The stigmata vary in position etc., as in the last variety. My specimens have come from Sligo, Hull, Hereford, Morpeth, Birmingham, Halstead, Rannoch, Darlington, Clevedon and Galashiels.

γ. var. suffusa, mihi = *stabilis*, Hb.—In this variety, the whole area of the wing becomes suffused with black scales. The general colour is usually blackish-grey, but is sometimes brownish, owing to a red tint in the ground colour. The outlines of the reniform and orbicular and the subterminal line, are very pale and distinctly marked ; the central shade is generally very dark and well marked. My specimens have come from Tilgate Forest and Hereford. Hübner's *stabilis* may be described as :—"Anterior wings of a dull, dark greyish-brown, with two black wavy transverse basal lines. The three stigmata outlined in paler ; the elbowed line wavy ; the ground colour of the wing beyond this to the outer margin, paler ; the sub-

terminal line pale, edged internally with blackish; the nervures distinct on the outer margin. The hind wings dark grey, with the base paler and lunule distinct" ('Sammlung europäischer Schmet.,' fig. 171).

δ. var. *junctus*, Haw.—This is the sub-variety of the type, in which the reniform and orbicular are united. It is described by Haworth as follows:—" *Bombyx*. Alis griseo-ferrugineis, annulis duobus confluentibus strigaeque postica pallidis." "Præcedenti (*cerasus*) simillima et fere eadem sed paulo minor. Antennæ minus pectinatae. Dignoscitur primo intuitu stigmatibus junctis nec liberis seu distantiusculis, unde nomen; cæteris præcedente omnino convenit. OBS. Nunquam ullo modo variat" ('Lepidoptera Britannica,' p. 123). This form of variation is so frequent in all the different varieties, that it is hardly worthy of special notice.

ε. var. *rufa*, mihi.—The anterior wings of this variety are of a bright red coloration, with a considerable amount of variation in the colour of the outlines of the stigmata and the transverse lines; so much so, that the wings are frequently unicolorous, at other times, they have distinct pale outlines to the stigmata and pale transverse lines. In this variety the subterminal is sometimes very pale and white, but the dark central band is rarely strongly developed. My specimens have come from Hereford, Romsey, Nottingham, Morpeth, Sligo, Forres and Chattenden.

ζ. var. *rufannulata*, Haw.—This dark reddish form of *stabilis* has not always a red, or even ochreous circumscription to the orbicular and reniform, and it is useless to keep the name for such an unstable character. As, however, Haworth's name comprises the reddish-fuscous forms, I have retained his name for all such dark reddish varieties. Haworth's description is:—" *Noctua*. Alis rufo-fuscis striga postica rufa extus pallida, stigmatibus liberis rufo-marginatis." "Præcedenti (*flavilinea*) valde affinis, at differt notabiliter ut in caractere specifico. Alæ posticæ præcipue in mare, nigricantes, ciliis fuscis; nec rufis ut in illa. Cæteri simillima. Sequenti differt stigmatibus liberis nec junctis, antennis masculinis longioribus, magisque pectinatis" ('Lepidoptera Britannica,' p. 243).

Tæniocampa, Gn., *pulverulenta*, Esp.

This little species (with *miniosa*) exhibits less variation than the other species of *Tæniocampa*. The ground colour exhibits none of the extreme range found in *instabilis* and *opima*, nor do the markings show any extreme forms as in *gothica*. The colour varies from a whitish-grey to red, but all the specimens are of one of these colours or a mixture of them: The transverse lines are generally ill-developed, consisting of dots, but occasionally the dots become united into distinct, wavy, black lines. The stigmata vary very much, the orbicular sometimes being obsolete, sometimes a pale ring, sometimes filled in with dark; the reniform is generally distinct, but varies in shade from being of the ground colour surrounded by a pale ring, to the whole being filled in with dark fuscous; its lower part is generally dark. The subterminal line is generally obsolete, or, if present, pale in colour. Between the subterminal and outer margin, there are frequently pale patches between the nervures, giving the same mottled appearance noticeable in many specimens of *gothica*. Humphrey and Westwood write:—"Varieties occur, in which the ordinary strigæ are rather

more distinct and the stigmata united. The female is duller coloured" ('British Moths,' p. 138). Esper's diagnosis of the type is:—"Alis deflexis superioribus griseis, atomis nigricantibus adpersis, et stigmatibus oblitterato fusco;" while of the general appearance of the species he writes:—"The fore wings are reddish-brown, sprinkled with innumerable minute black dots, mottled here and there with indistinct reddish-ochreous spots. In the middle stands a faint brown spot formed by the two discoidals. The female has this outlined more distinctly, owing to the paler ground colour." The figures to which this description refers are:—"Fig. 5, dark reddish, dusted with minute black atoms, reniform composed of three black dots placed transversely. Fig. 6, paler red, orbicular blackish with a paler outline, reniform 8-shaped, the two central areas of the 8 filled in with black" ('Die Schmet. in Abbildungen,' p. 386, Pl. 76, figs. 5-6). The *cruda* of Hübner appears to come near the type, but is of a browner colour, and not tinged so distinctly with reddish.

- 1.—Pale greyish or ochreous-white = var. *pallida*.
- 2.—Dull grey = var. *pusillus*. Haw.
- 3.—Pale reddish-grey = var. *nanus*, Haw.
- 4.—Dark reddish-grey = *pulverulenta*, Esp.
- 5.—Bright red = var. *rufa*.
- 6.—Brownish-grey = var. *cruda*, Hb.

a. var. pallida, mihi.—This is the palest form of the species. The anterior wings of a pale greyish or ochreous-white, with but a very slight (if any) reddish tinge. The males particularly have the reniform well-marked, and the elbowed line often forms a very distinct row of tiny black dots. My specimens have come from Farnboro' (Kent), Chattenden, Shooter's Hill, Hereford and Halstead (Essex).

β. var. pusillus, Haw.—This is a grey form of *pulverulenta*, which is described by Haworth as follows:—"Alis griseis stigmatibus contiguus obsolete lineolaque fusciscentibus, strigaeque marginali punctorum fuscorum." "Præcedenti (*nanus*) valde affinis, sed fere duplo minor magisque crassa pro ratione magnitudinis. Antennæ desunt. Abdominis barba grisea macula nigra quæ præcedens caret. Alæ anticæ magis rotundatæ seu retusæ, stigmatibus minus remotis, postico seu reniforme majore oblongiore saturatiore, lineola crassa fusca subinterrupta a stigmate anteriore versus basin ducta, quæ omnino deest in præcedente. Omnium nostratum *Bombycum* minimus est, sed pro ratione magnitudinis valde obesus" ('Lepidoptera Britannica,' p. 124). Grey *cruda* are not rare, with the reniform well filled in with fuscous; the central shade, too, is in this variety, altogether absent or indistinct. Of *pusillus(a)*, Humphrey and Westwood write:—"This species measures an inch in the expanse of the fore wings, which are of a dull grey colour, with the stigmata contiguous but obsolete and of a brown colour, with a broad, brown, interrupted line running from the anterior stigma to the base of the wing; the apical margin marked with a row of brown punctures; the abdomen is proportionately stouter than in the last, with a great beard having a black dot. Considered by Mr. Stephens as a variety of *O. cruda*; but Mr. Haworth states that the wings are more rounded or retuse in form. Taken in Richmond Park, but rare" ('British Moths,' p. 138).

γ. var. nanus, Haw.—This is the pale reddish-grey variety; perhaps the commonest form we get in Britain. It is described by

Haworth as follows :—" *Alis griseis stigmatibus distantibus obsoletis fuscis griseo cinctis, strigisque duabus obsoletis punctulorum fuscorum* " "*Præcedente (junctus) minor, sed antennæ magis pectinatæ rachi ferruginea radiis griseis. Alæ anticæ griseo-ferrugineæ punctis sparsis baseos fuscis. Stigmata distantia, anticum parvum subinde oblitteratum; posticum reniforme, et pone hoc ordo extus arcuatus punctulorum minutorum fuscorum, alterque magis obsoletus ad marginem posticum. Alæ posticæ fuscrescentes. Femina magis obscura*" ('*Lepidoptera Britannica*,' pp. 123-124). This most common variety I have from Hereford, Halstead (Essex), Epping, Eltham, Strood and many other localities.

δ. var. *rufa*, mihi.—This is the rarest variety of the species, and I am indebted to Dr. Chapman for almost all my bright red (often quite rosy) specimens. This form of variation is much rarer among the females than the males.

ε. var. *cruda*, mihi.—Hübner's *cruda* (*ambigua* by error) is a dark grey-brown form, with a reddish tint and distinct characteristic lines and markings (fig. 173). I have a long series of this dark greyish-brown form from Hereford.

Tæniocampa, Gn., *miniosa*, Fab.

This pretty species varies but little. The greyest specimens have a slightly greenish tinge, and the reddest are very bright rosy. The pale basal and elbowed lines frequently contain between them a redder central area, and thus produce a banded form. The pale subterminal line has frequently a transverse row of dark dots on its inner edge, giving a clue to the origin of the wedge-shaped spots so characteristic of certain species, and developed as black dots in certain varieties of the allied species in *Tæniocampa*. There is also a trace of orange dots outside the subterminal, suggesting the origin of the mottling frequently found in *pulverulenta* and *gothica*. It is wonderful how dark specimens become when rubbed or worn. I have never seen a naturally dark variety, and, if such occur, they should be carefully examined to see if such tendency is not really due to the absence of scales, which causes the specimens to present, as it were, a pseudo-melanic tendency. The hind wings of this species are pure white, with a transverse row of dots or a wavy line, and a dark lunule. Sometimes the white is tinged with a most lovely delicate rose colour. Humphrey and Westwood write :—"There is some difference in the tone, both of the ground colour of the wings and of the strigæ of this handsome species" ('*British Moths*,' p. 137). The description of the type is as follows :—" *Noctua lævis, alis deflexis: strigis tribus undatis maculisque ordinariis, miniaceis.* " "*Statura omnino N. trapezineæ. Antennæ pectinatæ ferrugineæ strigis tribus miniaceis. Versus marginem striga punctorum nigrorum. Posticæ albidæ striga marginali fusca*" ('*Mantissa*,' pp. 145-146). The following are the principal varieties :—

- 1.—Dull greenish-grey, with red central band = var. *virgata*.
 - 2.—Pale ochreous-grey, unicolorous = var. *pallida*.
 - 3.—Pale reddish, unicolorous = *miniosa*, Fab.
 - 4.—Pale reddish, with dark red central band = var. *rubricosa*, Esp.
- a. var. *virgata*, mihi.—This variety has the basal and outer areas of a pale grey with a greenish tint, which is especially noticeable when the specimens are fresh. The central area, from the complete basal line to the elbowed line, filled in with red, forming a distinct

central band. My specimens have come from Hereford, Wakefield, Brighton &c.

β. var. pallida, mihi.—This is the palest form of the species. The anterior wings are unicolorous ochreous-grey, with scarcely a trace of the reddish colour of the type. Transverse lines paler, and stigmata rather darker than the ground colour. My specimens have come chiefly from Hereford. I have a very pale specimen of this form, typical on the left side, but pallid and illmarked on the right, giving it a very strange appearance.

γ. var. rubricosa, Esp.—This variety has the anterior wings of the same rosy colour as the type, but the central area is of a much deeper tint, and forms a red band extending from the elbowed line to the basal line, and including the stigmata. Esper's diagnosis is as follows:—"Alis deflexis grisescentibus, fascia lata rufa et macula reniformi in medio fusca, serieque punctorum marginalium punctorum;" whilst the figures to which the description refers may be described as:—"Anterior wings pale orange-red, with a dark central redder band, the reniform, and basal and elbowed lines outlined with white, subterminal rather darker. Hind wings reddish-grey, transverse shade darker." Esper also adds:—"The ground colour of the fore wings of a pale flesh-colour; the reniform filled in with brownish, a broad reddish central band" ('Die Schmet. in Abbildungen,' iii., pl. 75, figs. 3-4, p. 381). I have some very strongly banded specimens from Hereford and Brighton.

Dyschorista, Ld., *suspecta*, Hb.

This species offers a considerable amount of variation, chiefly however, in the direction of two distinct forms. (1) An unicolorous reddish-brown form. (2) A form with the outer marginal area and inner margin of a much paler ochreous or reddish tint. The Scotch unicolorous specimens are very dark, much darker than those from York, and, although the species is generally distributed over England, it is really abundant in very few localities. Aberdeen and York appear to be its two chief centres. Although the great mass of our specimens may be roughly classed as almost unicolorous or much variegated, there are many minor variations; thus, specimens occur, purely grey or ochreous, with no tinge of red in them, and very bright red specimens, of the shade of bright *leucographa*, also occur. This latter (red variety) also, has its variegated form, which, with the outer and inner margins of a bright ochreous, forms perhaps the prettiest variety of the species. Of minor points of variation, some specimens have the stigmata strongly lined in with pale, and hence standing out very distinctly; others, have them lost in the ground colour. Occasionally a specimen has the space between the stigmata rather darker than the ground colour, reminding one of the quadrate spots in certain species of the genera *Noctua*, *Agrotis* etc.; the upper part of the reniform is frequently pale, whilst the lower is dark, and, although the three stigmata are generally traceable, there is frequently a tendency to obsolescence in the orbicular and claviform. There is frequently a row of black dots following the elbowed line, sometimes these are very distinct. Hübner's type may be described as of a "dull ochreous-brown tint with the two ordinary basal lines; the distinct stigmata outlined in paler; the space around and below the reniform rather darker; the elbowed and subterminal lines paler; a short dark streak from the

costa to the orbicular. Hind wings dark grey, base paler, with a dark lunule" ('Sammlung europ. Schmet.,' fig. 633.) Of this species Guenée writes:—"This species has been up to the present unknown to lepidopterists, and I treated it at first in my 'Essai' as a variety of a species generally known as *congener* or *iners*, but of which the synonymy is most obscure. In fact, the *Caradrina iners*, Treitschke, ii., p. 271, does not appear from his description to belong here at all. It is sufficient to prove this, when he states that the hind wings of the male are 'entirely white.' The *congener* of Geyer (fig. 862) represents our species well, but not that of Treitschke. Hübner's *suspecta* (fig. 633) is, in any case, much older than all other figures and descriptions; it faithfully represents a well-marked ♀ specimen" ('Noctuelles,' vol. v., p. 360). The following is an attempt to classify the principal varieties:—

- 1.—Pale reddish-grey, almost unicolorous = var. *pallida*.
- 2.—Pale reddish, outer area and inner margin ochreous = var. *congener*, Hb.-Gey.
- 3.—Bright red, almost unicolorous = var. *rufa*.
- 3a.—Bright red, with central area grey = var. *lævis*, Dup.
- 4.—Bright red, outer area bright ochreous = var. *variegata*.
- 5.—Dark blackish-red, almost unicolorous = var. *nigrescens*.
- 6.—Blackish-red, with the outer area pale = var. *nigrescens-variegata*.
- 7.—Pale ochreous, almost unicolorous = var. *iners*, Dup.
- 8.—Dull brownish, almost unicolorous = *suspecta*, Hb.
- 9.—Dark grey, almost unicolorous = var. *grisea*.

a. var. *pallida*, mihi.—This variety has the anterior wings of an almost unicolorous pale reddish with a grey tinge, the inner and outer margins being no paler than the rest of the wing, although the subterminal is fairly well marked. My specimens have come chiefly from Aberdeen and York.

β. var. *congener*, Hb.-Gey.—This is a pale reddish-grey variety, with the outer area paler. Geyer's figure may be described as follows:—"Anterior wings pale greyish-red, all the nervures dark and distinct, an abbreviated, followed by a complete whitish basal line, the stigmata outlined in black, the elbowed line black and wavy, a pale transverse band follows the subterminal, parallel to the hind margin; a double row of black dots runs through the pale band" ('Sammlung europäischer Schmet.,' fig. 862). Of this variety Guenée writes:—"The two sexes are similar, and only differ from the type in their more unicolorous testaceous colour and their slight reddish tint, the designs are generally less clear, except the stigmata, of which the outline is generally well marked" ('Noctuelles,' vol. v., pp. 360-361). I have specimens from Wharnccliffe, Aberdeen, Askham Bog &c.

γ. var. *rufa*, mihi.—This bright red variety of *suspecta* appears to be more common in Scotch than in English localities. The whole area of the wing is of a bright red with the ordinary lines and stigmata distinct, but no trace of a paler coloration replacing the ground colour. I have specimens from Rannoch and Aberdeen, and have seen others from Askham, but it is, I believe, rare in the latter locality. I have two or three extreme forms in which the red is especially bright.

δ. var. *lævis*, Dup.—Duponchel figures a bright red variety of *suspecta* under this name with a distinct dark greyish central band, all the markings are clearly developed. It is an excellent figure of *suspecta* despite Staudinger's query. Of the general variation of *suspecta*

which Duponchel calls *lævis*, he writes:—"The superior wings vary from yellowish-grey to ferruginous, but, whatever the shade of the ground colour, the designs are always the same, &c." "The sexes differ neither in colour, nor markings" ('Histoire naturelle' &c., vi., pl. 76, fig. 5, p. 65).

ε. var. *variegata*, mihi.—The ground colour of the anterior wings bright red, as in var. *rufa*, but with a distinct ochreous transverse band running parallel to the hind margin. It occurs with var. *rufa*. This would appear to be the var. B of Guenée, who writes:—"This is the opposite to *congener*, Gey.; it is of a brick red almost unicolorous, but with the subterminal more continued and much enlarged and widened; the stigmata are as distinct as in var. *congener*" ('Noctuelles,' vol. v., p. 161). My specimens came from Aberdeen.

ζ. var. *nigrescens*, mihi.—This is the darkest form of the species, It is of a deep blackish-red, the black being sometimes much more pronounced. The whole appearance of the variety is most sombre. The markings are indistinct and merge into the ground colour. I have specimens varying from deep dull sombre blackish-red to one specimen almost entirely black. I am indebted almost entirely to the Scotch collectors for this darkest form, although I have it from Thorne Moor in Yorkshire, and I believe, it occurs occasionally with the other vars. in Askham Bog.

η. var. *nigrescens-variegata*, mihi.—This is the form of *suspecta*, in which var. *nigrescens* exhibits the transverse band in connection with the subterminal line as in vars. *variegata* and *congener*. Again I find myself indebted entirely to the Aberdeen collectors for all the specimens I have of this variety.

θ. var. *iners*, Dup.—I agree with Guenée in throwing out Treitschke's description, as I am totally unable to apply it to this species. Duponchel's figure is of a greyish ochreous, darker on the costa, and a very little more ochreous on the outer and inner margins; the reniform and orbicular distinctly outlined, transverse lines distinct" ('Histoire naturelle' &c., pl. xxvii., fig. 2A). I have specimens from Pitcaple, varying to almost pure ochreous.

ι. var. *grisea*, mihi.—Of this dark grey form with no tinge of red, I have seen but few specimens in Britain. Duponchel's vol. iv., pl. 27, fig. 26, represents this grey form. The anterior wings dark grey, with the stigmata and transverse lines indistinct, and almost lost in the general ground colour. This is a decidedly rare variety. I have one specimen from Askham, and one or two others from Aberdeen.

Dyschorista, Ld., *fissipuncta*, Haw. (*ypsilon*, Bkh.).

This is a species which varies but little, and, with a short series, a lepidopterist might readily form the idea that it does not vary at all. This, however, is not so, as, besides the ordinary pale grey specimens, a few specimens are reddish-ochreous and a still smaller proportion blackish; whilst a mottled variegated form occurs, which, in its extreme forms is with difficulty recognised as this species. The stigmata offer in this species the most striking forms of variation. The orbicular and reniform are generally placed well apart, and separated in their upper parts by a dark triangular patch, but at the lower parts they shew a tendency to coalesce, and frequently the orbicular extends at its lower end into a pale longitudinal patch running for a short distance along the median nervure to join the reniform. The peculiar way in

which the upper and lower edges of the claviform occasionally extend outwards in the form of two curved black lines is very remarkable, and they occasionally extend outwards as far as the elbowed line, but such an extension is rare. The wedge-shaped spots so frequent in *Agrotis* are well-developed in this species. Borkhausen describes no particular form of the species, but makes a comprehensive description to include most of its various forms. Of the species he writes:—"The ground colour is variable, and differs in almost every specimen, sometimes it is a mixture of bistre- and umber-brown, sometimes it is greyish-brown, sometimes it is only a pale bark colour; there are the three ordinary stigmata, bordered with brown, and filled in with a blackish shade; the reniform and orbicular nearly join at their lower edges, and the space between them is usually γ -shaped and filled in with black; below the outer stigma is a small wedge-shaped mark, yellow-grey in colour with a brown border; there are varieties, where the reniform and orbicular are quite joined at their lower borders, and between them, above the junction, as well as before the outer stigma, there are black-brown spots; the claviform is bordered with black-brown and then has the appearance of an ϵ . In some, especially dark specimens, the stigmata are like the ground colour and only perceptible by the borders which are whitish. In other vars. between the reniform and inner streak is a trace of an arched line, and with a specimen before me this line is clearly marked" ('Naturgeschichte' &c., p. 504). From this it will be seen that Borkhausen knew almost as much of the general variation of this species as we at present know. Haworth's description of the type is as follows:—"Noctua alis subfuscis, notis duabus in medio nigris fissis." "Alæ pallide fuscae subnebulosæ costâ albo punctatâ. Stigmata ordinaria obsoletissima cinerascentia, inter hæc liturâ nigrâ, aliâque longitudinali oppositâ marginem tenuiorem versus fissis. Juxta marginem posticum striga obsoleta pallescens undata, intus punctis trigonis nigris plus minus adnata. Posticæ alæ pallidiores, sive pallide fuscæ" ('Lepidoptera Britannica,' p. 197). Guenée says of this species:—"It varies but little, except in the shade of the ground colour, which is sometimes paler and more ochreous" ('Noctuelles,' vol. v., p. 362); whilst Humphrey and Westwood write:—"All the markings of the forewings are, however, liable to obliteration, except the subapical pale striga, and occasionally the ground colour is almost black" ('British Moths,' p. 140).

The principal forms of this species are as follows:—

- 1.—Pale greyish-fuscon = *fissipuncta*, Haw. = *ypsilon*., Bork.
- 2.—Reddish-ochreous = var. *corticea*, Esp.
- 3.—Dark or blackish-fuscon = var. *nigrescens*.
- 4.—Variegated, dark with pale markings = var. *variegata*.

a. var. *corticea*, Esp.—This is the reddish form of *fissipuncta*, and Esper lays stress, not only on the colour, but also on the peculiar way in which the upper and lower borders of the claviform extend and branch out into the centre of the wing, forming, as it were, a bifurcation from the complete basal line. His diagnosis is:—"Alis fuscis, strigis, maculis, lineolisque duabus baseos bifurcatis (referring to bifurcation of complete basal line to form the claviform, and then extending beyond it) nigris, stigmatibus albidis." The figure referring to this description has "the anterior wings reddish-brown, the nervures blackish, the subterminal in the form of arches, and the stigmata out-

lined in black" ('Die Schmet. in Abbildungen,' p. 463, pl. 145, fig. 2). I would keep Esper's name for all the red forms of this species, independent of the special development of the claviform, which is a most inconstant character, and present more or less in all the varieties. I have specimens from Greenwich, Deal and Burton-on-Trent.

β. var. nigrescens, mihi.—This is Haworth's var. *β*, of which he writes:—"Alis anticis nigris, posticis fuscis, cæteris ut in *a* (*fissipuncta*), at saturatoribus" ('Lepidoptera Britannica,' p. 197). I have specimens of this dark variety from Greenwich and Deal, and intermediate forms from Burton-on-Trent.

γ. var. variegata, mihi.—Although difficult to describe in words, so different is the general appearance of this variety that, when I first captured it, I was unable to say for a considerable time to what species it belonged. The ground colour approaches var. *nigrescens* in tint, but is somewhat purplish; the costa is marked with a series of short black streaks; the orbicular and upper part of the reniform are very pale; the claviform is also pale; the nervures pale, with the spaces between of the darker ground colour, causing it to have a somewhat striated appearance; the basal lines pale; the elbowed indistinct; the subterminal also pale. All my specimens of this variety have come from Sandwich and Deal.

Orthosia, Och.

The two species of this genus bear a strong superficial resemblance in shape and general contour, despite their great difference in colour, and are characterised by a distinct black dot formed by the filling in of the lower part of the reniform. In *macilenta*, this dot is found in about 50-80 per cent. of the total number of specimens, whilst in *lota* the dot is very rarely absent, although in some very dark specimens from Sligo, and in a few pale specimens from other localities it is either not marked or so indistinct as not to be noticeable, but it is very rarely this is the case. In *Anchocelis helvola*, which seems to be a connecting link between *Orthosia* proper and *Anchocelis*, there are traces of the dot, but, in the remaining members of the genus, it is rarely present even in a modified form.

Orthosia, Och., *lota*, Cl.

This species varies very considerably, especially in ground colour. The greater number of specimens are of a dark grey, but this varies in opposite directions,—in some specimens producing quite a melanic colour, in others, a very pale grey, whilst a very red form is not at all uncommon. The lower part of the reniform is filled in as a black dot which is very conspicuous and is rarely absent; the dark central shade is generally traceable but never very distinct; the abbreviated basal line is generally confined to two dots, the complete basal line indistinct; the claviform generally obsolete; the elbowed line sometimes absent, at others, slightly traceable, with a row of minute dots in contact with it; the orbicular, reniform and subterminal generally outlined in reddish or ochreous. Newman writes of this species:—"The colour of the fore wings is dull leaden-brown, or dull ochreous-brown, the two shades being equally common; and there are also other intermediates of less frequent occurrence; the discoidal spots have a very slender pale circumscription, and outside of this a slender brick-red circumscription, the lower half of the reniform is almost black; parallel with the hind margin is an oblique compound line, the inner

portion of which is brick-red, the outer portion ochreous-grey; both colours are sharply defined and very distinct" ('British Moths,' p. 365). Clerck's figure may be described as follows:—"Anterior wings dark grey or lead colour, with the extreme base dark; the orbicular and reniform outlined in yellowish; a row of tiny black dots along nervure parallel to inner margin; subterminal line yellowish; three black costal spots between reniform and subterminal; a treble transverse row of dots occupying the position of the elbowed line" ('Icones,' pl. viii., fig. 1). Hübner's figure is (by error) called *munda*, and is of the typical form. The following are the chief forms of variation:—

- 1.—Pale whitish-grey = var. *pallida*.
- 2.—Dark grey or lead colour = *lota*, Cl.
- 3.—Blackish = var. *suffusa*.
- 4.—Reddish = var. *rufa*.

α. var. pallida, mihi.—This appears to be the palest form of the species. It is of a whitish-grey ground colour, the black reniform spot and red edge to the subterminal stand out conspicuously. The form is rare. I have it from Hartley Wintney, Bucks and Clevedon.

β. var. suffusa, mihi.—In this, the dark lead colour of the type has become almost black. The dark ground colour makes the reniform spot comparatively inconspicuous, there is also a distinct trace of the central shade. I have only seen specimens from Sligo, where my specimens were captured by Mr. Percy Russ.

γ. var. rufa, mihi.—The anterior wings in this variety are of a reddish tint. The only author who appears to figure this variety is Duponchel ('Histoire naturelle' &c., supp., pl. xxvii., fig. 4), but the figure is not a good one. The markings of this variety are the same as those which characterise the type. The dark centre to the lower part of the reniform, and the ochreous subterminal with its red inner edge are very marked. I have specimens from Somerset, Chattenden, Clevedon, Bucks, Darlington and Hartley Wintney.

Orthosia, Och., *macilentia*, Hb.

This interesting species not only exhibits a dimorphic tendency in coloration, some specimens being of a dark, others of a pale ochreous colour, but the dot, formed by the darkening of the lower part of the reniform, and which was mentioned as being particularly characteristic of *lota*, is in this species as frequently absent as present, so that in both the dark ochreous and pale ochreous specimens, there are the two forms, that without, and that with a conspicuous central black dot. Some specimens have a distinct central shade, others again, have no trace of it. The development of a complete row of dots following the elbowed line occasionally occurs, whilst in other specimens there is no trace of them; the two basal lines also show some variation in their development, but are represented by dots even in the best developed specimens, the second dot in the abbreviated basal line almost looks like a small longitudinal dash. Hübner's type may be described as follows:—"Anterior wings bright brownish-(almost reddish-) ochreous, with the second dot of the abbreviated basal line well developed, a wavy line between this and the orbicular; the orbicular outlined in blackish, the reniform in pale, the lower part of the reniform filled in with dark, an angulated central shade runs between the stigmata, whilst the elbowed line is also wavy; the subterminal pale, edged internally with dark. Hind wings dark grey, base paler, dark lunule"

(‘Sammlung europ. Schmet.,’ fig. 418). The *flavilinea* of Haworth is also the type. His diagnosis is:—“*Noctua* alis rufescentibus, striga postica obliqua rectissima flavicante intus rufa, punctoque basi fusco.” “Simillima precedenti (*cerasi*). Antennæ maris hirtæ pectinatæ, nec radiis validis. Alæ anticæ minus venosæ. Stigmata ordinaria magis distantia et lente obsolete flavicantia, basi postici sæpe fusco. Striga postica magis recta, magisque flava, sed ad costam obsoletior et parum geniculata. Alæ posticæ longe saturatiores, barbâ abdominis ciliisque magis rufis” (‘Lepidoptera Britannica,’ p. 243). The following appear to be the principal forms:—

- 1.—Pale straw colour, with distinct central dot = var. *straminea*.
- 1a.—Pale straw colour, without distinct central dot = var. *obsoleta-straminea*.
- 2.—Deep yellowish or reddish-ochreous, with central dot = *macilenta*, Hb.
- 2a.—Deep yellowish or reddish-ochreous, without central dot = var. *obsoleta*.

a. var. *obsoleta*, mihi.—Of the same dark yellow-ochreous colour as the type, but without the characteristic black spot which is developed in the lower part of the reniform. It appears to be found in most localities with the type. I have it from Frome, Aberdeen, Bristol, Clevedon, Sligo, Reading etc. I certainly have only the type from other localities, but do not think it betokens the absence of the variety.

β. var. *straminea*, mihi.—This variety differs from the type in having the ground colour very much paler. The markings are as in the type, and the characteristic black spot is present in the reniform. I have specimens from Clevedon, Bucks, Sligo, Hartley Wintney, Bristol, Aberdeen and Frome. A sub-var. of *straminea* (*-obsoleta*) occurs, in which the characteristic black spot is absent. I have such specimens from Farnboro’ (Kent), Hartley Wintney, Aberdeen, Reading and Clevedon. This sub-variety appears to be the rarest form of the species.

Anchocelis, Gn.

Of our British species, Guenée places *helvola*, *pistacina*, *lunosa* and *litura* in this genus, whilst Staudinger restricts it to *lunosa*, placing the other species in *Orthosia*. The two species, *pistacina* and *lunosa*, vary much, and are peculiar in having strongly marked longitudinal striations, which, almost typical in *lunosa*, are sometimes entirely absent both in that species and in *pistacina*, and at other times as strongly marked in *pistacina* as in the former species, the third species, *litura*, appears never to have this form. Another peculiar character of our three species left in the genus is the development of the tiny black costal streak at the commencement of the subterminal line. *A. pistacina* is by far the most variable species in the genus.

Anchocelis, Gn., *helvola*, Linn.

This beautiful species had two names given to it by Linnæus, *helvola* (the older) and *rufina* (the one in more common use). It is an exceedingly variable species, and the bright red of some specimens is very striking. In all its forms of variation, however, there are three fixed characters:—(1) a dark basal patch between the abbreviated and complete basal lines, (2) an angulated central fascia, (3) a transverse

series of dark oval patches filling up the space between the elbowed and subterminal lines. Occasionally these three characteristic patches are almost lost in the ground colour, whilst now and then, these markings are very dark and then become very striking. The claviform is generally obsolete, the reniform and orbicular ochreous and usually distinct, the lower part of the reniform is frequently dark and shows in a minor way, the more complete development found in *lota* and *macilenta*. Guenée writes of it:—"The number of names this species has received is due to want of study on the part of different authors. Even Linnæus used two names. It varies very little" ('Noctuelles,' vol. v., p. 364). I do not think Guenée could have known much about the species, or he would not have said that it varied very little. To me, it appears to vary a great deal. The Linnæan description of the type is:—" *Bombyx spirilinguis*, alis rufis: fasciis suffuscescentibus: postica latiore, subtus rufescentibus" ('Systema Naturæ,' x., p. 507). The chief forms are:—

1.—Ochreous with greenish tinge, and three reddish fasciæ = var. *ochrea*.

1a.—Ochreous, with dark purplish bands = var. *punica*, Bork.

2.—Dull reddish, with the fasciæ indistinct, almost unicolorous = var. *unicolor*.

2a.—Dull reddish, with the three fasciæ dark = *helvola*, Linn.

3.—Bright red, fasciæ indistinct, almost unicolorous = var. *rufa*.

3a.—Bright red, fasciæ distinct (tending to purplish) = var. *rufina*, Linn. = *catenata*, Esp.

a. var. ochrea, mihi.—The anterior wings with the ground colour ochreous and having a greenish tinge. This ground colour is broken by three distinct transverse fasciæ of a reddish colour,—one, between the pale abbreviated and complete transverse lines, a second, in the form of an angulated central transverse shade crossing the wing between the stigmata, a third, between the pale elbowed and subterminal lines, made up of a series of oval patches, the ochreous ground colour cutting through the band on the nervures. The hind wings with the outer area reddish, as in the type. My specimens have come from Reading, Wolverton, Farnboro' (Kent), Sandburn, New Forest, Rotherham and Aberdeen.

β. var. unicolor, mihi.—The anterior wings of an unicolorous reddish tint, the characteristic fasciæ being but little distinguishable from the ground colour. This form is comparatively rare. I have specimens only from Wolverton, Derby, Brentwood and the New Forest. This is really only an obsolete form of the same reddish ground colour as the type.

γ. var. rufa, mihi.—This is a bright red almost unicolorous form, with the fasciæ almost obsolete, and only just traceable as darker lines. It bears the same relation to the bright red form, *rufina*, that var. *unicolor* bears to the duller red type, *helvola*. I have specimens of this variety from Aberdeen only.

δ. var. rufina, Linn.—This is the most beautiful of all the *helvola* vars. The anterior wings are of a rich red, with reddish-fuscous fasciæ inclining to purplish. The Linnæan description is:—" *Bombyx spirilinguis*, alis depressis rufis: fasciis fusciscentibus: postica latiore, subtus rufescentibus" ('Systema Naturæ,' xii., p. 830). I have specimens from Aberdeen and Reading. It is also, I believe, the *catenata* of Esper. Esper's diagnosis is:—" *Noctua spirilinguis* sub-

cristata, alis deflexis fulvescenti-rufis stigmatibus flavescentibus, macula intermedia fusco-rufa, postice fascia saturatiore, punctis concatenatis, nigris terminata" ('Die Schmet. in Abbildungen' &c., p. 327). The figure to which this description refers has "the anterior wings bright red, with dark basal line and outline to orbicular, reniform dark outlined in paler, two rows of dots take the place of the elbowed and subterminal lines, the nervures pale on the outer margin" (*l.c.*, pl. 123, fig. 1).

ε. var. *punica*, Bork.—This has a yellowish ground colour with dark bands. Borkhausen writes:—"Ground colour yellowish with purplish brown bands; not far from the base is a reddish-brown band, bordered on both sides by a yellowish-brown line; then follow the ordinary stigmata outlined in yellowish; the orbicular is scarcely noticeable, the reniform is more distinct and in its lower part filled with blackish; it also interrupts the brown central shade which forms an angle at the point of interruption; the reniform is followed by a second reddish-brown band, with yellow margins and bordered on both sides by a row of elongated dark brown chain-like spots, which have a yellow tinge; on the outer margin runs a row of blackish-brown spots; the fringes are of the ground colour. The hind wings are ashy-grey with a darker band and yellowish (? reddish) hind margin" ('Naturgeschichte' &c., p. 687, No. 300). I have specimens from Rannoch, Reading and the New Forest.

Anchocelis, Och., *pistacina*, Fab.

This species in the range of its variation ranks with *Agrotis tritici* and *Teniocampa instabilis*, and, like the former species, our early authors separated this into a great number of what they considered distinct species. Of its general variation, Humphrey and Westwood write:—"This most variable insect measures from $1\frac{1}{4}$ to $1\frac{1}{2}$ inches in the expanse of the fore wings, which vary from pale rufescent-buff or stone colour, to bright fulvous-red, varied with grey shades. In some specimens, the ordinary strigæ and other markings are almost obsolete; whilst in others, they are distinct, consisting of a small blackish dot near the base of the wing, followed by an oblique striga formed of pale scallops, edged with blackish but becoming obsolete towards the costa, which is, however, marked with two dots indicating its place. This is succeeded by the anterior stigma, which is very small, and forms an oblique blackish short line; the other stigma is much larger, but rather narrower and oblique in the opposite direction; to its inner edge is united a curved striga formed of small dark scallops, terminating in a black dot on the costa half-way below the stigmata; another black stigmal dot is placed in front of the second stigma, beyond which is a slightly curved pale striga edged before and behind with dusky scallops, followed by another sub-marginal, pale, very indistinct striga indicated by black dots, and by a black patch on the costa; the extreme margin of the wing is also marked with a row of black dots. Such is the variety represented in Pl. 28, fig. 6, whilst fig. 4 represents another variety, in which most of these markings may be traced, appearing, however, only in a grey shade upon the red-brown ground colour of the wing; whilst fig. 5 represents another beautiful variety, in which the ground colour is bright red-brown, with nearly all the markings obliterated, except those of the costa and the stigmata" ('British Moths,' pp. 138-139); whilst

Newman writes:—"The fore wings are so various in colour, that it is impossible to define any particular colour as peculiar to the species; the prevailing tint is orange or ochreous-grey, sometimes inclining to brick-red, at others to grey-brown, and again at other times to simple ochreous; the discoidal spots are generally present, but in some specimens I find no trace of them; the reniform is long and rather narrow; it is outlined in pale yellowish-grey, and the median area is grey-brown; the orbicular is extremely narrow and very oblique; its obliquity is in a contrary direction to that of the reniform; the wing-rays are sometimes much paler than the general area, and when this is the case, slender transverse lines across them, give the entire surface of the wing a reticulated appearance; the costal margin is spotted, the spots being both darker and lighter than the ground colour; there are also several transverse series of darker spots or markings; the hind wings are very dark smoke-colour, with pale fringes" ('British Moths,' p. 367). Guenée writes:—"No species varies more than this, and none has been divided into more species. Its varieties are very difficult to classify, because, on the one side the passage of one race into others is so general and therefore difficult to limit; and again, because some names given by authors are not always well defined. The type itself is in the last category described by Fabricius from the collection of Schiffermüller, and figured poorly by Hübner. It ought to comprise those individuals of a clear brown or greyish, with the base a little paler, and the terminal and subterminal spaces darker, in which the subterminal stands out distinctly; the black dots numerous and the design generally well-marked. It is easily confounded with the var. *lychnidis*, and has, like that, the middle of the costa often streaked with white and the nervures more or less distinct" ('Noctuelles,' vol. v., p. 364). Fabricius' description of the type is as follows:—"Noctua cristata, alis deflexis cinereis apice obscurioribus undatis, posticis fuscis." "Corpus griseum. Alæ cinereæ striatæ, basi parum pallidiores punctis nigris, apice obscuriores striga undata pallida posteriorique e punctis nigris" ('Mantissa,' p. 175).

The following is an attempt to classify the varieties we get:—

- 1.—Pale greyish-ochreous, with faint, transverse, costal streaks and stigmata = var. *pallida*.
- 1a.—Pale greyish-ochreous, with distinct costal streaks and stigmata = var. *serina*, Esp.
- 2.—Pale reddish-ochreous, unicolorous = var. *obsoleta*.
- 2a.—Pale reddish-ochreous, with distinct costal streaks and stigmata = var. *spherulatina*, Haw.
- 2b.—Pale reddish-ochreous, with distinct markings and pale nervures = *pistacina*, Fab.
- 3.—Bright red, almost unicolorous = var. *ferrea*, Haw.
- 3a.—Bright red, with distinct costal streaks and stigmata = var. *lineola*, Haw.
- 3b.—Bright red, with distinct markings and pale nervures = var. *lychnidis*, Fab.
- 4.—Brown (slightly ochreous), almost unicolorous = var. *unicolor-brunnea*.
- 4a.—Brown, with distinct costal streaks and stigmata = var. *brunnea*.
- 4b.—Brown, with distinct markings and pale nervures = var. *venosa*, Haw.
- 5.—Blackish-grey = var. *canaria*, Esp.

a. var. pallida, mihi.—This variety is, so far as I know, the palest form of the species. The anterior wings are pale greyish-ochreous, or yellowish, the ordinary stigmata and transverse lines and short dark costal streaks being just traceable in a faint reddish colour; altogether it is a most pale and unicolorous variety. My specimens have come from Farnboro' in Kent.

β. var. serina, Esp.—This is also a very pale variety, the ground colour as in the preceding var. but with the stigmata, costal streaks, and transverse lines more distinct. Esper's diagnosis is:—"Alis deflexis, superioribus lutescentibus, stigmatibus nigris, margine anteriori nigro punctato, interiori ciliisque postici fulvis; inferioribus cinereis," whilst the figure to which this description refers may be described as:—"Ground colour pale yellowish, with the reniform outlined in darker, the orbicular linear and blackish; the transverse lines all traceable with short black lines on the costa where they commence" ('Die Schmet. in Abbildungen,' p. 522, pl. 156, fig. 2). For my specimens of this variety I am indebted to Mr. Alderson of Farnboro', Kent, but I notice that in them, in every instance, the reniform has a paler outline with darker shading inside. Staudinger writes:—"Al. ant. pallidissimis fere unicoloribus" ('Catalog,' p. 116), a remark which applies better to the previous form.

γ. var. obsoleta, mihi.—The anterior wings of this pale reddish variety have the markings almost obsolete. It is Haworth's *pistacina*, of which he writes:—"Noctua alis pallide ferrugineis, strigis quinque obsoletissimis punctorum subfuscorum." "Præcedenti (*sphærolatima*) nimis affinis, et forte mera ejus varietas. Strigæ omnes obsoletissimæ et fere oblitteratæ, at costa punctis validis fuscis, tribus in medio, quarto apicem versus: punctisque duobus aliis oblongis loco stigmatum divaricatorum. Posticæ fuscae ciliis rufis" ('Lepidoptera Britannica,' p. 231). This variety is much commoner than either of the preceding. I have specimens from Charlbury, Hartley Wintney, Farnboro', Frome &c. Guenée writes of this variety:—"It differs only from *A* (*rubetra* Esp.) in that the wings are of a pale reddish instead of a bright fawn colour" ('Noctuelles,' vol. v., p. 365).

δ. var. sphærolatima, Haw.—This is a well marked variety of *pistacina*, which is described by Haworth as:—"Noctua alis ferrugineis strigis numerosis punctorum nigrorum." "Alæ ferrugineæ costâ fusco punctatâ strigisque decem vel duodecim punctulorum fuscorum: viz. una basi imperfecta, secunda ante medium geminata, quarta obscura a stigmate postico: tunc quinta undata geminata, et inter hanc et apices ciliorum quatuor vel sex alæ confertæ, at regulares et æquidistantes. Stigmata ordinaria oblonga divaricata, nigra, vel grisea. Alæ posticæ perfusæ ciliis rufis" ('Lepidoptera Britannica,' pp. 230-231). This pale red form with distinct markings is very common.

ε. var. ferrea, Haw.—This is the unicolorous form in which the anterior wings are of a bright almost red colour. Haworth's diagnosis is:—"Noctua alis saturatissime ferreis punctis sex nigris." "Alæ saturatissime ferrugineæ unicolores, maculis sex nigris exceptis, in locis ipsis punctorum penultimæ (*pistacina*, Haw.) species. Posticæ alæ nigrae ciliis rufis" ('Lepidoptera Britannica,' pp. 231-232). I would include under this varietial name, not only the specimens with the four short, transverse costal streaks and two dark streaks in place of the reniform and orbicular, but those which are still more obsolete and in which these marks are not developed. This is a common form in

Britain. Guenée erroneously refers this form to *rubetra*, Esp., and writes of it :—"Of a bright reddish fawn colour, almost unicolorous and without markings, with the nervures concolorous; the costa often white, and always strongly marked with black at the origin of the lines; the two stigmata very narrow and well marked in blackish. It is one of the most common and at the same time most constant varieties" ('Noctuelles,' vol. v., p. 365).

ζ. var. *lineola*, Haw.—This is a bright red form with well-developed markings. Haworth's diagnosis is :—"Noctua alis saturatissime ferrugineis, strigis punctorum fasciisque duabus posticis fuscis." "Præcedentibus (*pistacina*, Haw.) nimis affinis, et forte varietas; at alæ longe saturatiores sunt. Strigæ duæ obsoletissimæ punctorum fuscorum ante stigmata divaricata oblonga: striga tertia a stigmate postico: tunc fascia obsoletissima saturatior, aliaque in ipso margine. Cætera ut in penultima (*sphærolatina*), at stigmata obsoletiora et fusco-brunnea" ('Lepidoptera Britannica,' p. 231). This appears to be (next to the last), the most common form of the species in Britain. I have specimens from Nottingham, Frome, Chester, Sligo, Hartley Wintney, Bromley and Farnboro' (Kent).

η. var. *rubetra*, Esp.—This is a sub-variety of *ferrea* almost as unicolorous as that variety, but with the extreme costal margin white. Esper's diagnosis is :—"Alis deflexis superioribus fulvis, punctis albis marginis anterioris, striis punctisque disci nigris; inferioribus cinereis, fulvo marginatis." The figure to which this refers may be described as :—"Anterior wings bright red, with darker nervures and short dark costal streaks, which are not continued into transverse lines in the basal area; the orbicular dark inside, the reniform 8-shaped with two black centres; the elbowed and subterminal lines dark; central shade developed" ('Die Schmet. in Abbildungen,' p. 523, Pl. 156, figs. 314). Staudinger says of this :—"Al. ant. fere unicoloribus rufis" ('Catalog,' p. 116). This is hardly correct, and applies much more readily to var. *ferrea*.

θ. var. *lychnidis*, Fab.—Of this variety Guenée writes :—"The principal character of this variety is in having the nervures well-marked in pale; yet, according to Fabricius, these ought not to pass beyond the elbowed line. The fact is, it is almost the same form as the type, but its colour is more ferruginous. This is the greatest difference" ('Noctuelles,' vol. v., p. 365). This very bright red form with pale nervures I have so far found rare in Britain and have only specimens from Farnborough.

ι. var. *unicolor-brunnea*, mihi.—This variety is of a distinct dull brownish hue, with scarcely any trace of red in the ground colour. It is a parallel variety to the obsolete forms *pallida*, *unicolor* and *ferrea*. I have it from Charlbury, Nottingham &c.

κ. var. *brunnea*, mihi.—This variety also has the anterior wings of a brown tint, with distinct costal streaks, stigmata and transverse lines, thus forming a parallel variety to vars. *sphærolatina* and *lineola*.

λ. var. *venosa*, Haw.—This is the commonest of the brown forms so far as my experience enables me to judge. Haworth's diagnosis is :—"Noctua alis sordide ferrugineis strigis duabus pallidioribus; margine postico late fuscesciente venis ferrugineis obsolete intersecto" "Præcedentibus (*ferrea*) simillima at distincta. Alæ anticæ puncto imperfecto basi, tunc striga obsoleta pallida ante, alteraque arcuata pone stigmata oblonga obsoleta divaricata fulvo-cincta. Pone has

strigas alæ fuscescunt usque ad cilia grisea. Striga fusca obsoleta excurrit oblique a basi stigmatis postici, usque ad strigam anticam in margine tenuiori, quæ huic speciei forte peculiaris est. Alæ posticæ fuscae ciliis cinereis, nec rufis" ('Lepidoptera Britannica,' p. 232). I have an extreme form of this variety from Dr. Chapman of Hereford, in which the reddish-brown colour is replaced entirely by a distinct brown with an ochreous tinge. I have seen no other exactly like it. Most of the specimens are as Haworth describes them "of a dirty reddish-brown."

μ. var. canaria, Esp.—This is the only described variety of this species, of which I have no British specimen which I can reliably refer to it, nor do I remember having seen one. Esper's diagnosis is:—"Alis deflexis, superioribus fusco nigricantibus; stigmatibus, striis longitudinalibus et transversis posticis flavis; inferioribus supra cinereis," whilst the figure to which this refers may be described as:—"Anterior wings dark blackish-grey with pale ochreous nervures and ochreous transverse lines" ('Die Schmet. in Abbildungen,' p. 524, pl. 156, figs. 5-6). Guenée writes of this variety:—"Generally larger, of a greyish or greenish-black, little or not at all mixed with reddish and always dark, so that the terminal spaces are concolorous. The nervures very distinct, the designs strongly marked, the costa concolorous. The blackish specimens which Treitschke mentions and which Dahl has recorded from Italy, appear certainly to belong here" ('Noctuelles,' vol. v., p. 365). Staudinger simply writes:—"Obscurioribus, fere nigricantibus" ('Catalog,' p. 116).

ν. var. metallica, Ckll.—This aberration was named by Mr. Cockerell. It was originally recorded by Mr. Stewart as follows:—"While sugaring near Caterham on October 6th, I took a fresh specimen of *A. pistacina*, which retains the usual markings, but each fore wing is ornamented with a large blotch of a metallic cast near the hind margin, and reaching from the costal to the inner margin" ('Entomologist,' vol. xi., p. 21). Mr. Cockerell writes of it:—"This remarkable aberration was described as having on each fore wing a large patch of metallic cast, thus simulating the condition that is normal with some species of *Plusia*" ('Entom.' vol. xxii., p. 3). Strange to say there is not normally, in this species, the slightest trace of a shiny or lustrous area where this metallic appearance was developed, although there is a slightly shiny area, parallel to the subterminal in the allied species *lunosa*. I can suggest no reason for such an abnormal development.

Anchocelis, Gn., *lunosa*, Haw.

This species has a very limited range on the Continent. The chief feature of the species is the longitudinal striation along the nervures of the upper wings, a character occasionally developed in *pistacina*. In colour, there are several very distinct shades, varying from pale ochreous to black. Haworth's description of the type is as follows:—"Noctua alis griseo-rufescentibus striga valida postica punctorum nigrorum, posticis albis lineola maculisque tribus fuscis." "Affinis præcedenti (*helvola*) at longe pallidior. Stigmata ordinaria valida fusca, anteriore ovali introrsum spectante. Tunc striga subundata obolestissima pallescens, strigaeque alia punctorum nigrorum validorum; et inter hanc et strigam, color saturatur. In ipso margine postico striga alia punctorum fuscorum. Posticæ albæ, lineolâ basi, quæ terminat in

lunula conspicua fusca medio alæ. Prope marginem posticum macula una alterave fusca. Striga ciliari interrupta nigra" ('Lepidoptera Britannica,' p. 230). Of this species Guenée writes:—"It varies no less than its congeners" ('Noctuelles,' vol. v., p. 367). Haworth's type is the var. *B* of Guenée, who writes:—"Anterior wings of a ferruginous-red, almost like *pistacina*, without any markings other than the series of spots on the subterminal which is of a distinct black" ('Noctuelles,' vol. v., p. 368). This red type of *lunosa* without pale nervures is one of the more common forms captured in this country. My specimens have come from Portland, Sligo, Bournemouth and Waterford. Of the general variation of this species Humphrey and Westwood write:—"Numerous varieties occur, both in the tint of the ground colour of the wings, and in the strength of the markings, some of which are occasionally obsolete" ('British Moths,' p. 139). Under the name of *neurodes*, H.-S., Guenée gives a general description of all the phases of variation of the paler forms of the species. He writes:—"Superior wings of a brownish-yellow, greenish, or reddish, with the median shade, the edging of the lines and the inside of the stigmata of a deeper brown. The black spots in the subterminal very apparent" ('Noctuelles,' vol. v., p. 368). There are two distinct series of forms in *lunosa*, one without and the other with pale nervures. I have the obsolete forms in the paler varieties but none in the darker. In the latter the pale nervures are generally well-developed. Of this species Newman writes:—"The colour of the fore wings is various, sometimes rich bistre-brown, at others pale olive-brown, or pale ochreous-brown; the discoidal spots have a pale circumscription and a dark median area; the wing-rays are generally decidedly paler than the general area of the wing; and a pale transverse band, always accompanied by a series of very dark spots, crosses the wing parallel with the hind margin: the hind wings are pale with a conspicuous dark discoidal spot, and an interrupted dark bar parallel with the hind margin" ('British Moths,' pp. 368-369). The following are the principal varieties of this species:—

- 1.—Pale ochreous (slightly reddish), without pale nervures = var. *obsoleta*.
- 2.—Brownish-grey, with pale nervures = var. *humilis*, H. & Wd.
- 3.—Red or reddish-grey, without pale nervures = *lunosa*, Haw.
- 4.—Red or reddish-grey, with pale nervures = var. *rufa*.
- 5.—Dark red-brown, with pale nervures = var. *brunnea*.
- 6.—Dark grey-brown, with pale nervures = var. *neurodes*, H.-S.
- 7.—Blackish-grey, with pale nervures = var. *agrotoides*, Gn.

a. var. obsoleta, mihi.—This variety is of a pale ochreous ground colour with a slight reddish tinge, the pale nervures are obsolete, so that the wing is not striated longitudinally as in most of the other varieties. The stigmata are distinct, but the transverse lines are more or less obsolete except the subterminal row of dots which varies much in the amount of its development. The hind wings are whitish, the central lunule distinct, the outer dark fascia (parallel to hind margin) indistinct and broken. This form occurs in both sexes. I have specimens from Portland, Sligo and Newbury. The first figure in Newman's 'British Moths,' p. 368, is like this var., but the hind wings are generally paler.

β. var. humilis, Humphrey and Westd.—The striated form belonging to var. *obsoleta*, has a rather browner colour than var. *obsoleta*,

due, perhaps, to the direct contrast of the pale nervures with the ground colour. The anterior wings are brownish-grey with distinctly paler nervures, the stigmata and transverse lines distinct, the subterminal line pale, bordered inside with a row of dots, which is very variable as to the number developed. The hind wings of the males are whitish, of the females darker. I have specimens from Deal, Sligo and Bournemouth. This would appear to be the *humilis* of Humphrey and Westwood who write:—"The fore wings are of an ochre-brown, with the costa and veins whitish" ('British Moths,' p. 139).

γ. var. *rufa*, mihi.—The red form of *lunosa* without pale nervures is the type; the red form with pale nervures is var. *rufa*. This appears from my collection to be rarer than the type, as I have only specimens from Sligo and Bournemouth. I presume, however, this is apparent only, and that both forms are really equally common.

δ. var. *brunnea*, mihi.—A very strong development of var. *rufa* is found, in which the bright red colour becomes developed into a deep, dark red-brown, but still retains the pale nervures. I have specimens from Sligo, Bournemouth, Deal and Waterford.

ε. var. *neurodes*, H.-S.—This variety would appear to be a slight modification of var. *brunnea*, in which the red-brown of that variety and the blackish-grey of var. *agrotoides* are somewhat combined. Herrich-Schäffer's figure may be described as:—"Anterior wings very dark grey-brown with the nervures white and fine; the abbreviated and complete basal lines pale, edged with black; the orbicular indistinct, the reniform dark inside; a central shade from costa to inner margin; the elbowed line edged with black internally; a black apical mark on costal termination of subterminal line; outer margin paler. Posterior wings grey, with a transverse row of dark dots near outer margin followed by a dark transverse shade and dark lunule" ('Systematische Bearbeitung' &c., pl. 94, fig. 289 (89 by error)). This is the *subjecta* (fig. 3a) of Duponchel, which, however, has slaty nervures, not white ones.

ξ. var. *agrotoides*, Gn.—This is the most extreme dark form of *lunosa*. Guenée considers his *agrotoides* and *lunosa* synonymous, and writes:—"We may consider as the type those specimens of which the superior wings are grey-black, with the nervures marked distinctly in pale yellowish, the two stigmata filled in with black" ('Noctuelles,' vol. v., p. 367). This is one of the commonest forms in Britain. My specimens have come from Portland, Deal, Bournemouth, Winchfield, Waterford and Sligo.

Anchocelis, Gn., *litura*, Linn.

This species is subject to very little variation in Britain, the limit in the way of colour being between a dark fuscous red and a bright red, whilst the basal area is sometimes paler than at others. It is particularly constant for a member of an otherwise variable genus. The Linnean description of the type is as follows:—"Ph. *Noctua litura spirilinguis cristata*, alis canis fascia fusca liturisque quatuor marginalibus nigris." "Statura Ph. *gothica* sed minor. Alæ superiores canæ lituris quatuor, marginalibus, transversis, nigris, æquali spatio remotis; harum 1 ad basin alæ; 2 connexa cum oppositæ alæ lineola undulata nigricante; 2 connexa cum opposita fascia lata, obsoleta, fuscescente, arcuata; 4 ad apicem obliqua lineola, etiam subtus

conspicua" ('Fauna Suecicæ,' p. 320). From this it would appear very doubtful whether we get the type in Britain, for entirely whitish (hoary) forms with fuscous transverse lines and black marginal streaks cannot be at all frequent with us, as I have never seen one. It would appear, therefore, that the Linnæan type is an extreme northern form, foreshadowed by the strong pale base in some of our Scotch specimens, the pale colour extending over the whole wing in still more northern localities. The pale-based form is much more common in Scotland than England, where the species has usually a much brighter reddish ground colour, and the basal area is much less often pale grey. The following appear to be the principal forms:—

- 1.—Whitish, with dark transverse lines = *litura*, Linn.
- 2.—Purplish fuscous, with pale base = var. *borealis*, Sp.-Schn.
- 3.—Purplish fuscous, without pale base = var. *ornatrix*, Hb.
- 4.—Bright red, with pale base = var. *rufa-pallida*.
- 5.—Bright red, without pale base = var. *rufa*.

a. var. borealis, Sp.-Schn.—Sparre Schneider first described the purplish fuscous form with a pale base, under this name ('Nedenæs Amts Lep.,' p. 69). The diagnosis in the 'Entomologisk Tidskrift,' 1885, p. 74, is as follows:—"Framvingarne i inre hälften blågrå."

β. var. ornatrix, Hb.-Gey.—I described Geyer's figure as follows:—"The anterior wings are of a purplish-grey coloration with no distinctly paler base; the abbreviated and complete basal streaks are double and black; the usual dark costal streaks are present; the orbicular and reniform are dark and both are outlined with paler; a large, triangular, dark costal blotch is situated between the stigmata, with a short black line (part of central shade) from the base of the reniform to the inner margin; the elbowed and subterminal lines are pale. Hind wings dark grey, with paler base and a distinct lunule" ('Sammlung europäischer Schmet.' fig. 813).

γ. var. rufa, mihi.—Instead of the dark purplish coloration of the type, this variety has the anterior wings of a bright reddish-brown, the ordinary transverse lines and stigmata being generally well developed. Whilst, in Scotland, almost all the specimens captured are referable to the type or var. *ornatrix*, those from the South of England are principally this variety or var. *rufa-pallida*.

δ. var. rufa-pallida, mihi.—This bears the same relation to var. *rufa* that var. *borealis* does to var. *ornatrix*, having the basal, paler than the outer area. But whilst var. *borealis* is more common than var. *ornatrix*, this form appears to be rarer than var. *rufa*.

Besides the above, the following two varieties are mentioned by Continental authors:—

a. var. polluta, Esp.—Of this variety Guenée writes:—"In spite of the bad figure of Esper, his *polluta* appears to me to be the same as the *ornatrix* of modern authors. M. Freyer who gave it as distinct, and who thought he had reared it from a different caterpillar to that of *litura*, recognised in his 'Supplement' that it was only a variety." Guenée then goes on to say:—"It is larger, all the lines are strongly developed and the black spots are large and well-marked, even the costal triangle" ('Noctuelles,' vol. v., p. 369). Esper himself considered *polluta* a var. of *litura*. Staudinger keeps it distinct from var. *ornatrix*, describing *polluta* as "larger and darker" and *ornatrix* as

“smaller and darker” (‘Catalog,’ p 117). I think myself that Esper’s figure represents a large dark *litura* but it is excessively bad.

β. var. meridionalis, Stdgr.—This variety is described by Staudinger and I am unable to refer it to any of our varieties. He writes ;—“Al. ant. unicolor. cæruleo- vel flavo-griseis, fascia tantum media maculaque apicali rufescentibus” (‘Catalog,’ p. 117).

ADDENDA.

p. 51, *Agrotis tritici* var. *subgothica*, Haw.—With regard to my note on the use of Haworth’s name in America, I pointed out the error in the ‘Canadian Entomologist,’ xxiii., p. 159, and Mr. Grote has now put matters right by sinking *subgothica*, Haw., as an American species. In future, the American species will be called *jaculifera*, Guen. (*vide*. ‘Canadian Entom.,’ xxiii., p. 202).

p. 96, *Triphæna orbona* var. *pallescent*, Ckll.—The variety of this species, mentioned in the ‘Entomologist,’ xx., p. 240, was named by Mr. Cockerell in the ‘Entomologist,’ vol. xxii., p. 4. The only description given is :—“The hind wings creamy-white instead of a bright yellow” (‘Entom.,’ xx., p. 240). In ‘Entomologist,’ vol. xxii., plate vi., fig. *ε* has a pale left underwing. I have seen other similar specimens; see also Mr. Gregson’s remarks *ante* p. 99.

CORRIGENDA.

p. 105, five lines from bottom for “*hyperbore*” read “*hyperborea*.”

p. 116, ten lines from bottom for “*conua*” read “*conflua*.”

p. 7, delete *ε. var. turris*, Grote. Prof. Smith says that this is a distinct species, and not a var. of *A. saucia*.

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